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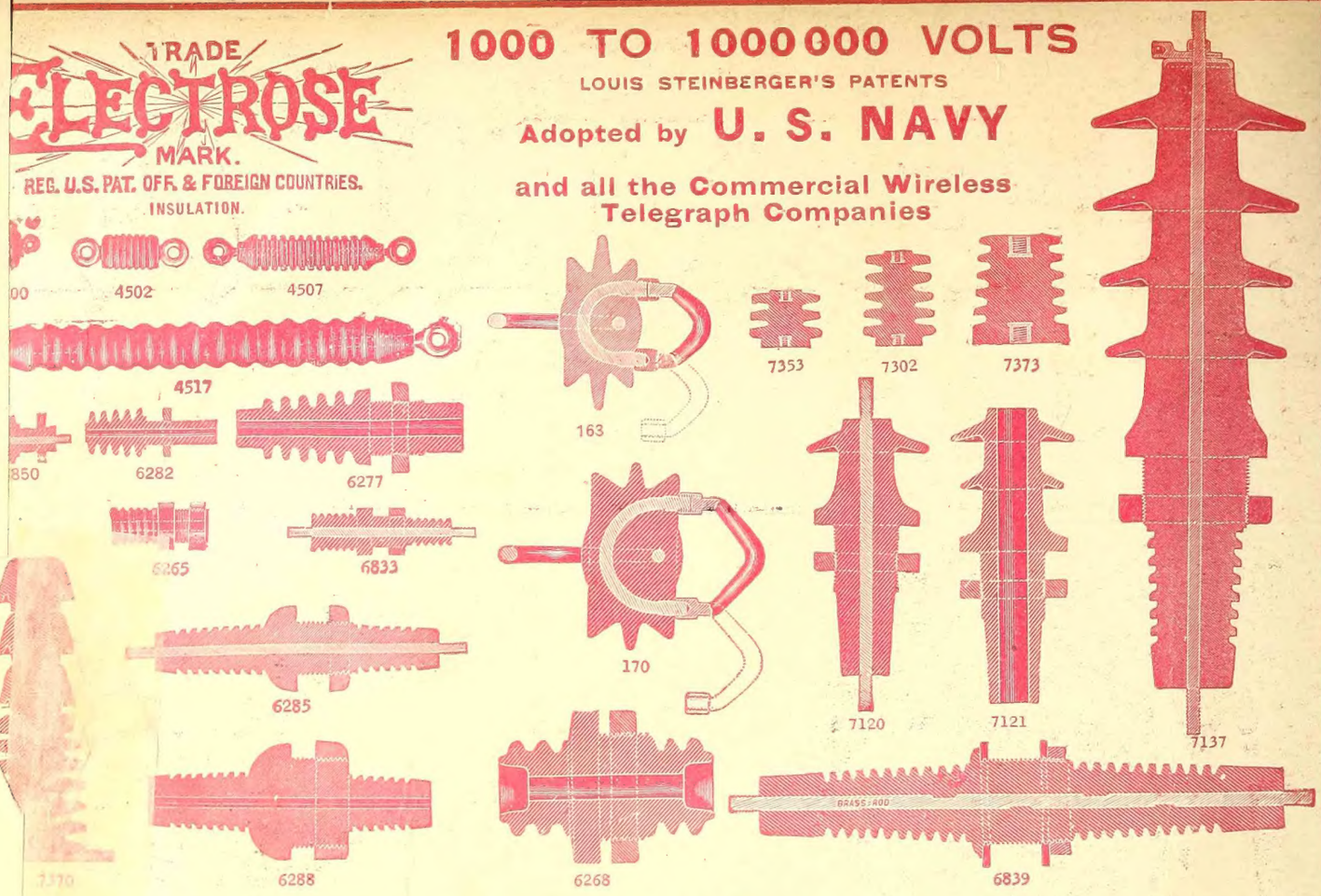

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Music In Colors

WHEN we go to the theater we have all probably noticed the wonderful effect that different colors play on the total effect produced on us by a certain stage setting or musical number.

A new device has been tried recently in Carnegie Hall at New York to give "color music," as it may be termed (see Fig. 1), and a special piece of music was prepared for this device by the composer, Scriabine, and produced as part of the piece, "Prometheus."

The "color organ" instrument has a keyboard of 12 colors, red, rosy-orange, yellow, green, pearly blue, "the shimmer of moonshine," bright blue, violet, purple, steely, "steely with the glint of metal" and dark red.

The composer's dream was to build a palatial theater so contrived that the audience should be bathed in rhythmical light as it listened to the music.

Modest Altschuler, conductor for the Russian Symphony Society, described the effect of the color music on the new instrument as "intoxicating," and said that if the instrument proved to be a valuable accompaniment to an orchestra, scores for it could be written so that it could be used for other pieces.

Fig 2

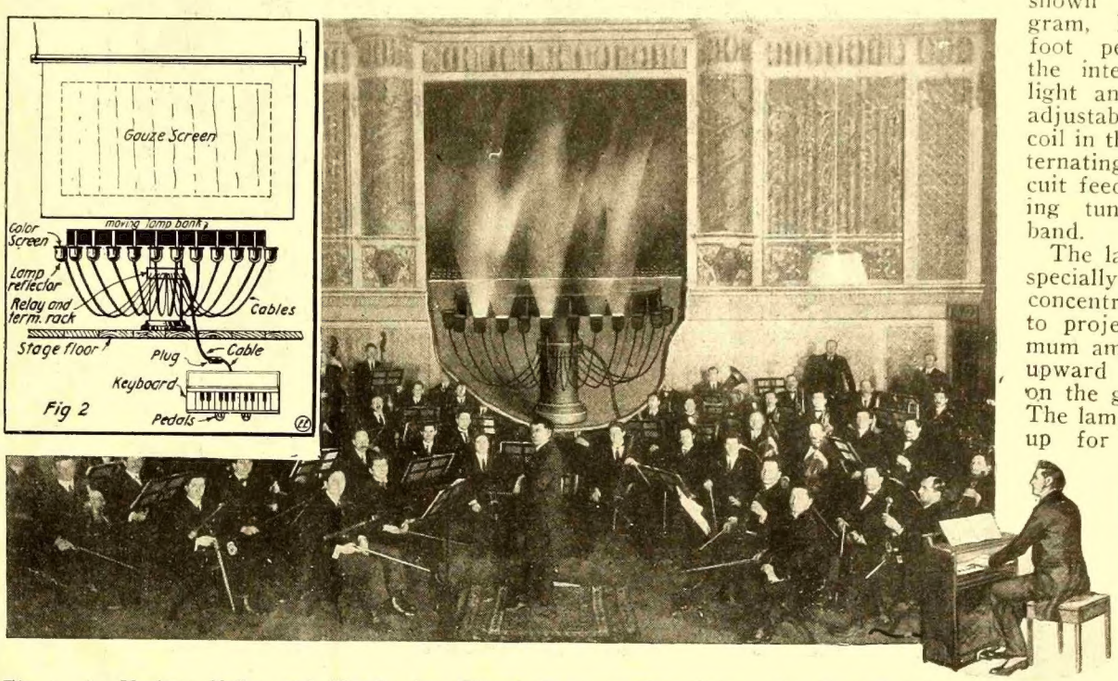

Fig. 1. As Various Notes and Chords Are Played Corresponding Colors Are Projected Upward Through Gauze Screens as Shown. Color Organ is Controlled by Keyboard and Pianist at Right. Fig. 2 Shows Details.

Note musician playing color music keyboard at right.

Simply described, the musical color scheme is worked out as follows: For every changing mood in the music a different color is taken, as given for a certain note, etc., and which color also represents as near as possible the feeling of the soul, so to speak.

We show diagrammatically at Fig. 2 how this light effect is managed. This device was built on short notice under the guidance of Preston S. Miller, of the Electrical Testing Laboratories, New York, and therefore future installations may be wonderfully improved. Referring to the diagram, a continuous band of high power tungsten lamps are caused to move half way around the belt circuit, and back again continuously; as long as the *color notes* are being used.

Flexible insulated cables connect to each lamp as seen, and over each tungsten lamp is fitted a color screen.

Over this "color organ" is placed a frame about 12 by 15 feet at the front opening. In this frame are placed several pieces of various kinds of fine transparent gauze, which hang slightly in folds. This scheme, combined with the always moving and intermixing bands of color as projected upward, forms a wonderful effect.

The keyboard, which is similar to a piano, can be played by any pianist, the musical score being written in regular notes on ruled paper, the same as any music. Color intensity variation is obtained by means of two foot pedals at the base of the keyboard. Hence the wonderful range of colors and tints possible is evident.

In laying out this musical color scheme the composer of "Prometheus" made use of an arbitrary color scale, as might be suspected. Rimington had previously worked out an equivalent system for this purpose, but the new arrangement was as follows, the tone notes being:

C ..... Red.
D ..... Yellow.
E .....Pearly Blue.
F-sharp ..... Blue
A ..... Green.
B-flat .....Steely Gray.

And so on. Various combinations of these colors were made easily possible by the keyboard, which resembled piano keys, and thus it was easy for the player to strike a chord, the same as in ordinary music.

The operation of the keys and lamps is not direct but indirect, to avoid handling any heavy currents at the keyboard. The keys when depressed close a direct-current circuit through corresponding relays mounted on the central supporting column, shown in the diagram, Fig. 2. The foot pedals control the intensity of the light and operate an adjustable impedance coil in the 110-volt alternating-current circuit feeding the moving tungsten lamp band.

The lamps were all specially made with concentrated filaments to project the maximum amount of light upward through and on the gauze screens. The lamps were made up for this work through the courtesy of the General Electric Co. The necessary color screens were placed in slides over each lamp reflector, and colored gelatine was largedly used for this work, placing it between two clear glass plates. For such colors as red, a plain red glass was used.

The great success of the effect produced with this device was due in great part to the ingenious arrangement of the gauze screens. The most flimsy screens came first, then next heavier gauze, etc., ending up with a rather stiff and coarse mesh netting. The color effect on the audience was quite marvelous indeed, as the different, always-changing colors were really seen through each other.

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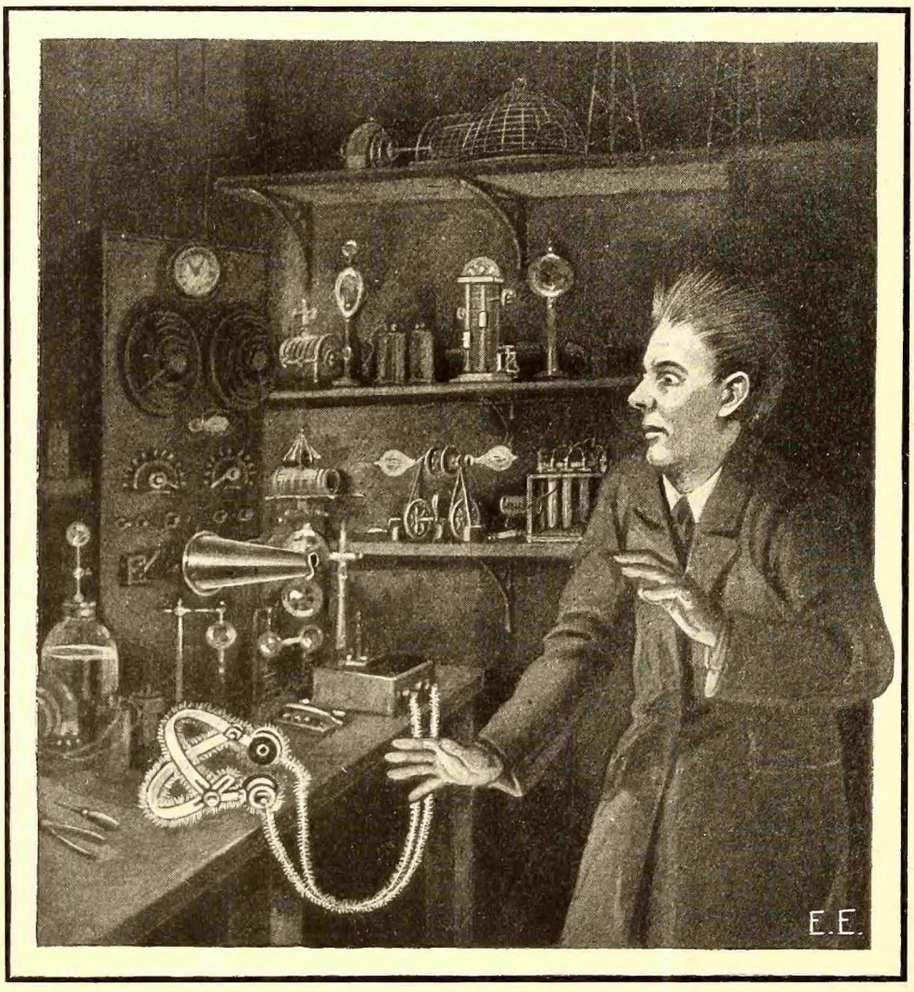
Baron Münchhausen's New Scientific Adventures

By Hugo Gernsback

I Make a Wireless Acquaintance

MY name is Ignaz Montmorency Alier. If that don't suit you I suggest I. M. Alier for short. I am a Yankee by birth; no doubt you guessed that much. Both my father and mother came over on the Mayflower and settled in Yankton, Mass., where they are engaged at present in cactus and ostrich farming. Ever since I was a little boy my father, for reasons best known to himself, begged of me to be a worshipper of truth, no matter how painful it might prove. I am glad to say that my father's teachings fell on fertile territory. I have never knowingly uttered an untruth. The pursuit of truth since I have grown up has become a mania with me, so much so, in fact, that even an everyday exaggeration made by my best of friends drive me frantic. I understand my [illegible] that peculiar state of mind, as far as truth is concerned, it will probably be best understood by the average layman if I say that truth with me is nothing less and nothing more but a hobby—a sort of sport, if you wish. I collect truthful statements as you would collect stamps. Particularly beautiful and original examples of truth are written down by me on large white cards. These cards are all indexed and classified and kept, vertically filed in card drawers. The originator (may I say inventor?) of these truths is, of course, given full credit on these cards, so that it is easy to find in years gone by who made this or that particular truthful statement. You will not think me immodest if I state in passing that nine-tenths of the cards contain my own name as originator of original and surprising truths. Of course, as truth is a science with me, such a statement cannot cause much surprise; I realize this fully.



* * * the Receivers Suddenly Became Enveloped in a Scarlet Phosphorescence, Glowing Softly Like the Light in an X-Ray Tube.

I would not think of taking up your valuable time with the above statement were it not so vitally necessary for me to fully acquaint you with my character, for reasons which will be more apparent later. For this reason I also find it quite necessary to give you the following references; any of the below mentioned individuals and institutions will be only too glad to vouch for my integrity, honesty, as well as veracity.* I could give almost an indefinite list, but I prefer mentioning only the following:

Hiram O'Rourke, lawyer, Yankton, Mass.

(The above defended me in three breach of promise suits, as well as eight perjury charges of which I was accused.)

Patrick Flanagan, jailkeeper, Yankton, Mass.

Jeremiah Addlecock, jailkeeper, Coffeeville, Me.

Mike Whiffeltree, jailkeeper, Lyreville, Vt.

(The latter only knew me intimately for five months.)

The Ananias Club, Yankton, Mass.

Now that I have thoroughly established my standing I will proceed, and I sincerely hope and trust that no one will question any statements I may be called to make in these pages. They are the bare, unvarnished truth in each and every case. If called upon I will cheerfully swear to the truth of any of my statements before a notary. (I am a notary myself.)

As every resident of my home town knows, I own the largest wireless plant in the State. I own the only long distance wireless telephone station in the country. As is known, I hold the long distance wireless telephone record of the world. Already in 1900, when my set was not nearly as perfected as it is to-day, I could talk around the world and converse freely with myself, the message traveling clear around the globe. This fact was described at length in "The London Scientific Gazette of 1900." (See Vol. XX, No. 19, page 39.) It attracted much attention at the time, but it was declared commercially impractical, for the reason that it was argued; if it is necessary to build a giant wireless station at a tremendous expense in order to talk clear around the globe, for the sole purpose of listening to one's own voice, why not talk to yourself without the expensive wireless? My critics contended that it would be far less expensive and perhaps more satisfactory.

Of course, this argument, quite logical as it was, for the time being discouraged me not a little, but soon I took up my studies anew and made many important new discoveries.

As president and founder of the now defunct *American Wireless Mouse Trap Co.* I learned a lot about rats and mice and this knowledge even to-day is of high importance to me.

The above company, as will be remembered by many, operated at one time no less than 80,169,509 wireless mouse traps all over the country. If we had not been so eminently successful in killing every mouse and rat in the country the company would, no doubt, be still in business. As it is, the American public calls me its greatest living benefactor for ridding the country of these pests, and this alone is honor enough and cannot but speak well for me. For the benefit of my young readers who never saw one of my wireless mouse traps let me give a brief description of same.

Each trap was constructed like a squirrel cage. The opening to the cage was fashioned in such a manner that a mouse or rat could get in it, but not out of it of its own accord once in it. Now, as anyone can readily convince himself by trial, mice and rats are exceedingly fond of revolving cages. They will travel for miles to get one. It has a most powerful fascination for them. They simply adore it and go wild about it. I am almost tempted to say that they go crazy about it, for they find it extremely hard to stop once they start running. Upon this great natural law I based my invention.

The shaft of the cage was connected to a little dynamo, which was operated at high speed as soon as the mouse or rat started the cage revolving. The dynamo in turn was connected to a little wireless set and this in turn to an aerial wire system on the roof of the house. The wireless set was constructed in such a manner that when operated it would send out a call similar to a Western Union call box. In each locality we had a wireless "central" with operators. As soon as one of the operators received a call he would look up his call book and see where the call originated. This took but a few seconds. A man would then be dispatched immediately to the house in question, where he would brain the mouse or rat on the spot, single handed, by means of a club. He would next reset the trap and return to headquarters, giving a full itemized report of the case. To the inexperienced my system of killing the rodents might appear rather long winded and expensive, but it is here where my in-

*On account of the numerous inquiries received concerning me I suggest to enclose a 2-ct. stamp for your reply when writing.

sight into human nature came to its full bloom and made me famous.

Not everybody likes to kill rats and mice. This is particularly true of the feminine humans inhabitating this globe. Why this should be so I do not profess to know absolutely, although I have some vague opinions on the subject, which, however, I would rather keep to myself. Suffice it to say, bipeds in skirts rather employ their time otherwise than catching, not to mention, killing rats and mice. What, therefore, I ask was more natural for me than to employ professional ratters and mousers, to perform the disagreeable tasks? At any event, you may be sure, the company was a huge success and many a fair damsel even to-day sends me highly perfumed letters hailing me as the liberator of the fairer sex's arch-enemies.

But this brings me away from my story. As I said already, I own the largest wireless telephone station in the country. It is exceedingly well appointed and contains instruments and apparatus of which the greatest living scientists have as yet not the faintest knowledge.

This story starts on a bitter cold December night. I could go to some length by writing two or three columns at two cents a word, stating how the wind sang weirdly through my aerial wires on the roof; how the flames of my log fire cast fantastic shadows about the room; how my cat was softly purring on a chair near by, dreaming of some long departed appetizing canary; how the windows rattled uncannily in the storm; how the trees moaned plaintively outside, and so forth. Thus I could set the scene and prepare you for the story—getting you under tension, as the editor calls it technically.

As a plain matter of fact, however, the aerial wires were full of sleet and therefore could not "sing," furthermore I was glad that they didn't come down, which would have made some music, although not very pleasant music. Then the log fire, too, could not very well have cast fantastic shadows either, nor any other shadows for that matter, because the log fire happened to be a radiator. Instead of casting fantastic shadows, however, it cast a lot of . nk noise about and every now and then made me jump clean out of my chair. Then, also, the cat could not have purred very readily on the chair because it wasn't a cat at all, but a dog to begin with, and he could not have purred even if he had taken lessons at $5 an hour. There were, however, good reason for this, too. Firstly, it was not a he; it was a she. Secondly, she had been dead for two years and only because she was stuffed so nicely did I keep her. Thirdly, she could positively not have sat on a chair near by, simply because there was only one chair in the place and I was on it. Fourthly, dogs, especially dead dogs, are not known to dream about appetizing canary birds. Then, too, the windows could not have rattled in the storm where I was, for my wireless station is in the cellar and that cellar has no windows whatsoever. As for the trees moaning or not moaning I explained above that my people were engaged in cactus farming. There are no trees on the farm, and cactus does positively not moan in a storm. It squeaks.

Now that you understand the situation fully I will proceed. It was after 12 o'clock midnight on a cold winter night. My new, loud talking telephone receivers were on my head and I had just lit a fresh pipe. I had been flirting with my vario-selective coupling-balance which was adjusted to a very long wave length—96,000 meters, if my memory serves me right—and I was just in the act of tuning down to the wave length of *F. L.*—that's the Paris Eiffel Through my receivers came a very faint, but exceedingly high pitched screaming sound, which became louder and louder each second. While I was still wondering what this unearthly sound could be, I suddenly heard in a faint but clear voice:

"Alier, Yankton, Mass.—80,000 meters." This sentence was repeated several times. I lost no time in starting my 200 K. W. generator, tuned up to 80,000 meters, and yelled into the transmitter in front of me.

"Ship ahoy! This is Alier of Yankton, who's there?" Almost instantly it came:

"It is I, Hieronymus Karl Friedrich Baron Münchhausen . . ."

At that I almost swallowed my pipe, but just the same, the colossal nerve of that fellow aggravated me.

"You confounded liar, stop your joking," I yelled back, "if you have to say anything, say it and be quick about it, for I am going to bed in a few minutes."

"My son," it came back in sepulchral tones, "I am not at all surprised at your astonishment. Rest assured I expected you would doubt my identify. However, I have proofs. It is now 12.50 a. m. terrestrial time. Kindly mount to the top of your roof. You will find it to be a clear night, the moon being half full. Take your watch along and observe the moon carefully. Precisely at 1 a. m. I will illuminate the dark half portion of the moon with a red phosphorescence, three times beginning 1 a. m., each illumination to last five seconds with a 10 second interval between each illumination. After this return to your phones. I have spoken. . . ."

The peculiar high pitched screaming sound was heard once more in my receivers. It ran rapidly down the scale, became fainter and fainter—there was a low click in my 'phones and everything was quiet.

I must have sat dumbfounded for at least a minute before I could recollect my senses. I took the 'phones off my head and wiped off the perspiration mechanically. I am sure I was dazed. I looked at my hands, moving them back and forth before my eyes, but I wasn't certain then that I was awake. So I took a pin laying near by and shoved it in my thigh. I knew then that I really was awake. I wanted to think, but I had to laugh outright. Why, the thing was preposterous. Some practical amateur joker, no doubt, who tried to get me on the roof and then afterward have me the laughing stock of the town.

"Good stunt! Rather novel idea, ha, ha! . . . But that sepulchral, earnest voice, that distinct accent, the peculiar intonation . . . could it?" . . .

My eyes fell on the clock before me. It was 12:55. At that very moment my 'phones emitted a loud crackling sound, like "static" before a thunderstorm. As I was looking on wondering, the receivers suddenly became enveloped in a scarlet phosphorescence, glowing softly like the light in an X-ray tube.

I know now that my hair must have raised at the sight of the uncanny phenomenon. I recollect that I grabbed my cap and run up the stairs, knocking somebody down as I flew by, pushed the trap open and sank down on the roof almost exhausted. Mechanically I pulled out my watch. It was 11:59. I shivered and looked intently at the moon, sailing in a beautifully clear sky, in which the stars sparkled with unusual brilliancy.

The moon was half full, the dark half being jet black and undistinguishable from the black sky. A clock near by started to strike 1 o'clock. The sound was still vibrating in the air when I witnessed a most remarkable phenomenon. The dark portion of the moon was suddenly faintly illuminated with the same scarlet phosphorescence which I had seen but a few seconds before around my receivers.

It seemed to me as if there was a gigantic searchlight stationed on the bright side of the moon, throwing a colossal shaft of that scarlet light over on the dark side. This shaft of light was not stationary, but it swept rapidly back and forward over the dark face of the moon, illuminating the moon's craters in a wonderful fashion. The phosphorescent light shaft was so long that it went actually clear across the face of the moon and swept out into the space beyond for a considerable distance. It was the most magnificent, inspiring spectacle I had ever witnessed in my life. Suddenly the light vanished for a short period, just as the mysterious party had said it would. I counted to 10. Just as sudden the sweeping light shaft appeared anew brushing the moon's dark face a few times back and forward as before. The light disappeared again; I counted to 10 and it reappeared, going through the identical motions for the third and last time.

For a few seconds I stood fascinated probably with my mouth wide open. Like in a trance, I went down to the wireless, and I still remember while adjusting the 'phones over my head that my teeth were chattering violently and that I had a cold chill which shook me from head to foot.

I had scarcely adjusted the 'phones when the high pitched screaming sound was heard again, and in a few seconds the voice with the graveyard tone spoke once more:

"I trust, my boy, that you will not doubt again Baron Münchhausen's word," here I could distinguish a low chuckle, "but tell me, how did you like my little exhibition?"

"Why, your excellency," I stammered back into the transmitter before me, "I really had no idea of offending you before, the whole thing seemed so impossible to me that you can hardly blame me for doubting your words. However, after seeing your wonderful lunar fireworks I stand ready to believe anything and everything that you may say. I assure you I will swear by it. But would you be so kind to answer me the burning question which is uppermost in my mind just now? Am I not correct in my assumption that your excellency was born in 1720 in Hanover, Germany, and was buried in 1797 in the same locality?"

"Most assuredly, my boy, you have stated the facts absolutely correct. As you say. I was buried in 1797, but if you were to open the coffin to-day you would not find a bone of Baron Münchhausen. For political reasons it was very desirable for me to 'die' in 1797, for if I had not 'died' just then they would have hung me dead, no doubt. So I had a wax replica made of myself, which looked so much like my dear self that it even deceived my trusted valet, Fritz, who came within an ace of placing me in the coffin while I was sleeping peacefully but soundly in a secret room in my attic alongside of my wax figure. If I had not sneezed in my sleep they would have buried me undoubtedly and let my wax replica shift for itself in an unfriendly world. While this might have been a regrettable accident, it would have hardly affected me much, for I am immortal, as you no doubt know!" A chuckle was discerned by me at this pun, the Baron no doubt liking his own little jokes.

"However, in the absence of Fritz, that blunderer Rosskopf, the embalmer, enters the house very much under the influence of Schnapps and by pure chance finds the secret room. He sees me sleeping soundly and thinks, of course, that I am dead. He, being either too lazy or else too drunk, I never knew which, he fails entirely to cut me open and to embalm me in the usual

(*Continued on page* 10).

How We Get Our War News

A Glimpse Inside the "News" Lines. By H. Winfield Secor

THE problem of gathering and properly distributing to the various newspapers throughout the country, the latest war news, or in fact news of any character, is one of the greatest problems encountered by the Associated Press Bureau. This useful news organization has its main offices located in New York City, where it has facilities and the necessary electrical installations and circuits, enabling it to promptly receive and transcribe all the latest news from every part of the country and also from the cables across the ocean as well as long distance wireless.

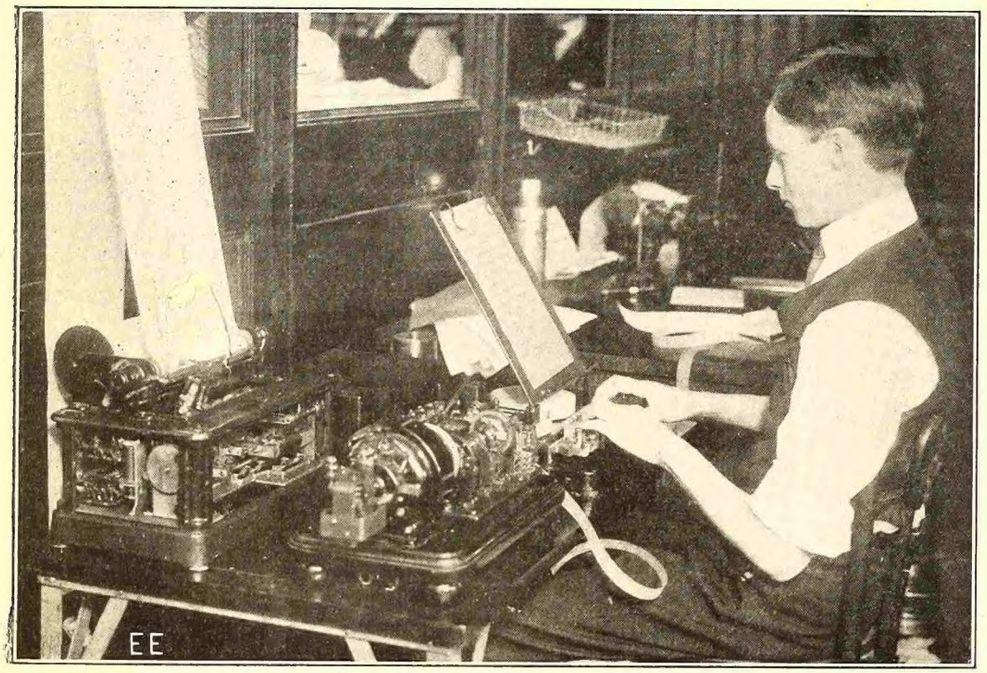
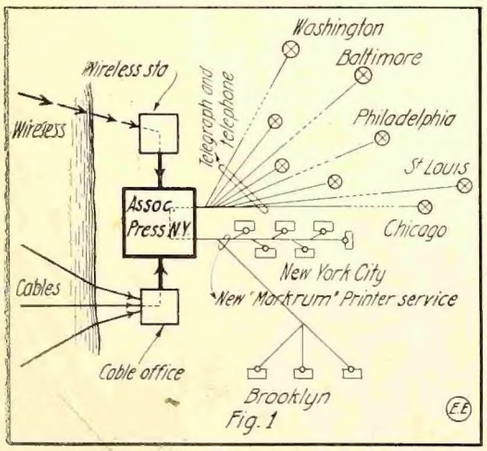


Photo (C) by Underwood & Underwood.

Showing Morkrum Sending and Receiving Printing Telegraph System Installed in Associated Press Offices in New York City. Local Printer to Left.

When the news is received in the forms of telegrams, etc.; after the news is edited, it is transmitted to the various newspapers throughout the country and city who subscribe to this press service. So far, and as has been the case for many years, the news is transmitted to outlying districts and distant cities by Morse code over the telegraph wire. However, a newly perfected transmitting system, known as the "Morkrum" arrangement, is now in use for New York City and vicinity by the Associated Press. It may be remarked to start with, that in the news transmitting office of this association, there are handled on the average 32,000 words per day.

The diagram at Fig. 1 will make clear how the network of "news" gathering and distributing lines terminate in a common clearing house, or as we know it, the Associated Press. Cables and radio bring in the news from across the ocean, while telephone and telegraph serve to handle the land "news" service.



How the Associated Press Gathers and Distributes "News" From New York City as a Center.

With the previous arrangement and making use of Morse telegraph operators for transmitting this news to the various newspapers in New York and Brooklyn, it required a great many extra messengers to deliver some of the news, and also a number of Morse operators; as the average speed available by this form of electrical transmission of intelligence is rather low or about 25 to 30 words per minute.

We show herewith the new Morkrum code (Fig. 2), as used with their machines, and as seen a series of round perforations in a paper tape serve to transmit the proper sequence of electrical signals over the line to the various newspapers, to actuate a printing receiver at the end of every line. Fig. 3 shows a specimen of this perforated paper tape. This tape is prepared very quickly and easily by means of a perforator in the form of an ordinary typewriter with a keyboard exactly similar, so that any typist may with very little instruction and practice operate same successfully. By reading the rows of dots across the paper in connection with the code here given, the reader can very easily decipher the meaning of the news item included on this particular piece of tape.

We show herewith also illustration of the transmitting and receiving instruments of the Morkrum pattern and two of the transmitting instruments are now in use in the Morkrum transmitting room of the Associated Press. These two instruments work simultaneously sending out news over a common circuit of two wires. Whatever papers require the news at the particular moment are switched on to the transmitting circuits by means of a plug and jack switchboard, similar to that used in telephone work. Means is provided for the attendant at each receiving station to notify the sender of trouble with the machine.

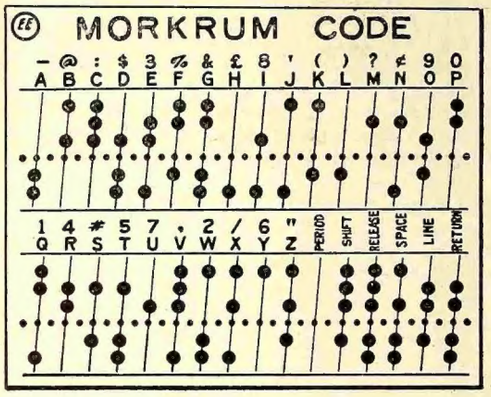


Fig. 2.
The New Morkrum Automatic Printing Telegraph Code.

The instruments are of the very finest workmanship, of course, and work with lightning rapidity and precision. The transmitter in the form of a typewriter as already mentioned, also includes the transmitting battery of polar relays; to the number of 12, which successively send out at high speed, the necessary positive and negative electrical impulses over the line to the receiving printers. As soon as the end of a printed line is reached a red light glows under the keyboard of the transmitter. The operator then presses his shift key for line spacing as many times as the printed lines are to be spaced apart. At each transmitting station, a local printer is simultaneously operated so that all of the messages sent out can be checked or watched to see that the spelling is correct and that one line is not being printed over another, etc.

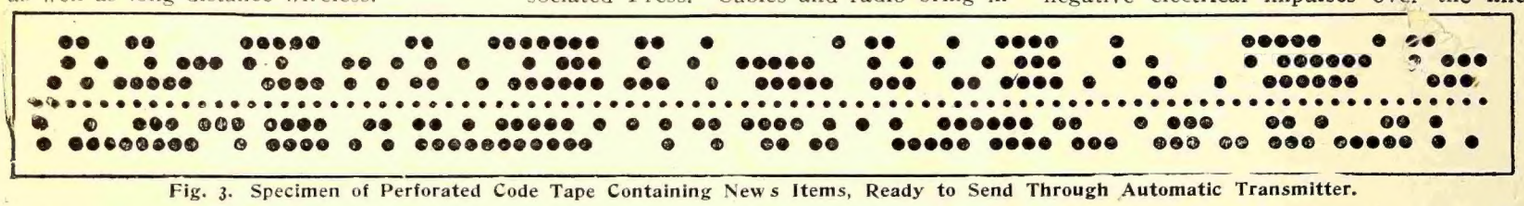


Fig. 3. Specimen of Perforated Code Tape Containing News Items, Ready to Send Through Automatic Transmitter.

As the speed of this system is much higher than that available when ordinary Morse telegraph instruments are utilized and when the greatest rush of news occurs; which is, by the way, about 11 a. m. to 1 p. m. each day; it is generally the case that three operators or more perforate the tapes simultaneously, as these tapes can be passed through the transmitting machines at very high speed, say 60 to 70 words per minute and more. It is thus seen that two transmitting keys using this tape, can take care of as many as four operators. The received news at each station is printed in type on a continuous paper roll about eight inches wide. It is detached from the printer as the machine feeds it out.

Electricity and Nature—A Thunderstorm Primer

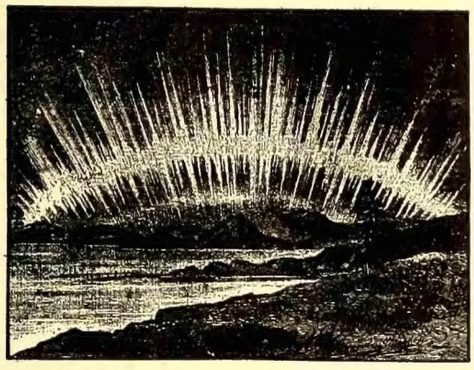
(Concluded)

What is Voltaic electricity?

Voltaic electricity is the electricity that is developed during *chemical changes,* and is so called after Volta, who enlarged upon the theory of Galvani.

What are the differences between mechanical, or friction electricity, Voltaic electricity, Galvanism, and magnetism?

Frictional electricity is electricity *suddenly* liberated under the effects of the *motion,* or the mechanical disturbance of bodies.



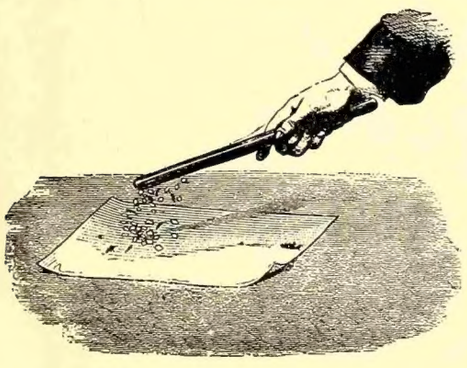
The Aurora Borealis or "Northern Lights." Believed to Be of an Electrical Nature.

Voltaic electricity is a *steady flow* of an electric current, arising from the *gradual changes of chemical* action.

Galvanism and *Voltaic* are also *identical,* since the latter is founded upon, and is a development of, the former. But the term *Galvanism* is frequently used when speaking of the development of electricity in *animal bodies.*

Magnetism is the electricity of the *earth,* and is also understood to include the *fixed electricity of terrestrial bodies.*

Man knows not *what electricity is;* yet by an attentive observance of its *effects,* he avails himself of the power existing in an unknown source, and produces marvelous results. When the Grecian philosopher, Thales, sat rubbing a piece of amber, and watching the attraction of small articles of matter to its surface, he little knew of the mighty power that was then whispering to him its offer to serve mankind. And when Franklin, with the aid of a boy's plaything, drew down an electric current from the clouds, and caught a spark upon the knuckles of his hand,



Illustrating the First Principle of Electricity. The Electrified Stick of Sealing Wax.

even he little conjectured that the time was so near when that strange element, which sent its messenger to him along the string of a kite, would become one of man's most submissive servants.

So many great results have sprung from the careful observation of the simplest phenomena, that we should never pass over inattentively the most trifling thing that offers itself to our examination. Nature, in her revelations, never seeks to *startle* mankind. The formation of a rock, and the elaboration of a truth, are alike the work of ages. It was the simple blackening of silver by the sun's rays which led to the discovery of the *chemical agency of light.* It was the falling of an apple which pointed Newton to the discovery of the *laws of gravitation.* It was the force of steam, observed as it issued from beneath the lid of a kettle, that led to the invention of the *steam-machine.* And it is said of Jacquard, that he *invented the loom* which so materially aided the commerce of nations, while watching the motions of his *wife's fingers,* as she plied her knitting. As great discoveries spring from such small beginnings, who among us may not be the herald of some great truth—the founder of some world-wide benefaction?

That the area of discovery has not perceptibly narrowed its limits, is evident from the fact that the greatest elements in nature are still mysteries to man. And though it may not be within the power of a finite being to unravel the chain of wonders that enfold the works of an infinite God—still it is evident, from the progress which discovery has made, and from the good which discovery has done, that God *does* invite and encourage the human mind to contemplate the workings of Divine power, and to pursue its manifestations in every element, and in every direction.

The wonderful force of *electricity* astonishes us the more when we view it in contrast with that equally wonderful element, *light.* We have seen that light travels with a velocity of 186,000 miles in a second, but that it falls upon a delicate balance so gently, that it produces no perceptible effect. As far as we know the nature of *electricity,* it is even *more etheral* than *light;* yet, while the *ether of light* falls harmlessly and imperceptibly—even with the momentum of a flight of *ninety-five millions of miles,* the *ether of electricity,* bursting from a cloud only *five hundred yards* distant, will split massive stones, level tall towers with the dust, strike majestic trees to the ground, and instantly extinguish life of man! *Why* does *the one ether* come divested of all mechanical force, while that which seems to be *even more etheral* than it, is capable of exerting the mightiest force over material things? Does it not appear that the Creator of the universe has established these paradoxes of power to testify his Omnipotence—to show to man that with Him all things are possible; and that, in the grand cosmicism of the universe, every attribute of Omnipotence has been fulfilled?

Let us now consider man's relation to this Omnipotence. He sees that electricity smites the tall edifice, and observes that in doing so it displays choice for a certain substance through which it passes harmlessly, and that its violence is manifested only when its path is interrupted. Man, taking advantage of this preference of electricity for a particular conductor, stretches out an arm of that substance, and points it upwards to the clouds; electricity accepts the invitation, and passes harmlessly to the earth. But this is not all; man learns by observation that electricity resides in all matter; that it may be collected or dispersed; that it travels along a good conductor at the rate of a *fifth-of-a-million of miles in a second of time;* he constructs a battery, a kind of a scientific fortress in which he encamps the great warrior of nature; and then, laying down a conducting wire, he liberates the mighty force; but its flight must be on the path which man has defined, and its journey must cease at the terminus which he has decreed where by a simple contrivance of his ingenuity (the movements of a magnetic needle), the electric current is made to deliver whatever message of importance he desires to convey. Thus, the element which in an instant might deprive man of life, is subdued by him, and made the obedient messenger of his will!

TO AVOID DANGER.

Why is it necessary to avoid proximity to water and streams during lightning?

Because water being a good conductor, a person standing near it, being also a good conductor, might determine the discharge.

Why is the middle story of a house the safest part to be in during an electric storm?

Because lightning sometimes *passes upward from the earth;* hence it is a mistaken notion of safety to take refuge in a cellar. In instances where houses have been struck with electricity from the earth, the force of the shock has abated as the electricity ascended.

Why is the middle of a room the safest place?

Because it is removed from *conducting surfaces,* such as bright mirrors, bell-wires, walls, cornices, etc.

Why is it advisable to stand on a thick hearth-rug or on a hair mattress?

Because, being dry, and non-conducting bodies, they would *insulate the human body,* and prevent the electricity from passing to it.

Showing the Effect of the Union and Separation of the Charcoal Points.

Why is it dangerous to approach the fire-place in an electric storm?

Because the heated air, smoke, vapour and soot act as conductors.

Why should a person riding in a carriage during a thunderstorm, sit upright?

Because electricity may pass through the sides or back of the carriage.

The rule should be observed to avoid all *elevated* objects, which, as well as being elevated, are of a *slow conducting* character. The advice has been frequently given to avoid the neighborhood of conducting bodies; but when those bodies offer *perfect conduction* they convey electricity to the ground. Thus, to stand by or be within a church or lofty building, *properly fitted with lightning conductors,* is far safer than to stand near a tree, or a lofty building, *without a lightning conductor,* because electricity always seeks *the best conductor,* and the human body being a better medium than either a tree or a house, electricity would fly to it, even though it may first have seized upon one of the other objects. It must not be supposed that churches and houses having lightning conductors are not touched by electricity because no shock is felt or witnessed; their lightning rods are continually facilitating the movements of electricity, and probably passing, harmlessly, currents which, if resisted, would shatter the edifices to pieces.

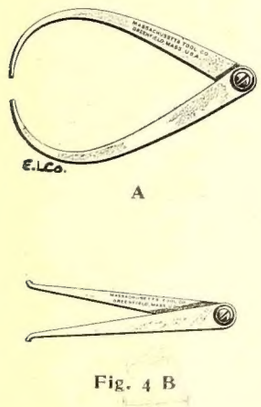
(*Continued on page* 10.)

Experimental Electricity Course

S. Gernsback and H. Winfield Secor

LESSON 20.
HOW TO MAKE THINGS
(Concluded.)

Tap numbers each correspond to certain decimal parts of an inch, and can be found in any tap or drill catalog. A few of



A

Fig. 4 B
Inside and Outside Calipers

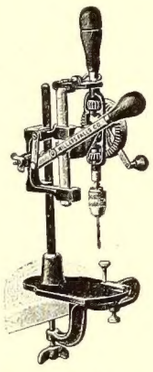


Fig. 6
Small Drill Press

Fig. 5
Hack Saw

the common tap numbers and their inch equivalents are cited below (Kent):

Tap or screw number.	Diameter of body of screw. (Max. diameter.)
No. 2	.0842″
" 4	.1105″
" 6	.1368″
" 8	.1631″
" 10	.1894″
" 12	.2158″
" 14	.2421″
" 16	.2684″
" 18	.2947″
" 20	.3210″

As seen from the above, No. 14 size tap is slightly smaller than ¼ inch, hence it is nearly the same whether ¼″—20 pitch or No. 14—20 pitch is designated; but a ¼″—20 machine screw fits into a hole tapped with a No. 14—20 tap pretty snugly, and the exact designation should always be watched and adhered to.

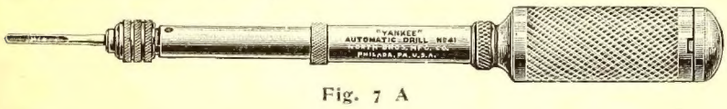


Fig. 7 A

For tapping threads in holes a tap, Fig. 8 A, is utilized in a tap wrench or holder B. The holder has an adjustable chuck taking several sizes of taps. For cutting threads on rods, etc., a steel die and holder, Fig. 9, is employed. In drilling and tapping cast iron no oil is required. For working wrought iron or steel oil is always used. Brass, aluminum, or any other metals require oil for drilling and tapping of any considerable extent.

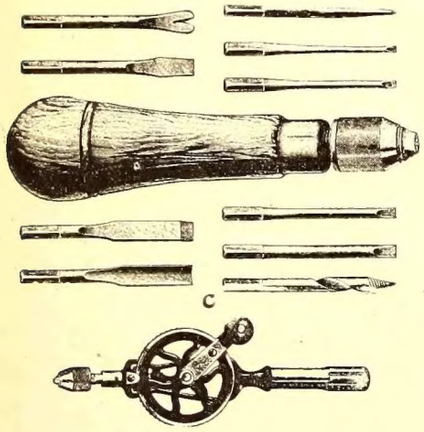


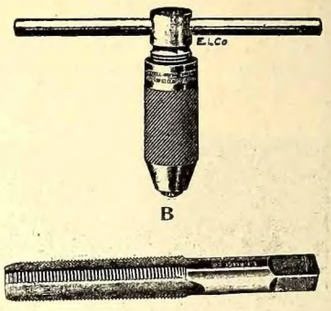
Fig. 7 B

A vise is essential in all shop work, and a neat one capable of being clamped to a table top is seen at Fig. 10.

A most useful machine is the lathe, upon which any shape of wood, fiber and brass may be turned up, and a good one for the amateur cost but little. A pair of heavy scissors, known as tinner's snips, are very handy for cutting out sections of thin fiber, tin, sheet iron, etc., not exceeding 1/16″ thick.

For laboratory or shop use, in heating joints to be soldered, brazing and innumerable other operations, the Bunsen gas flame shown at Fig. 11 is a valuable asset. It uses the regular house gas, and by a set of air holes at the base transforms the flame into a strong blue one of intense heat, instead of the yellowish flame of low heat emitted by the usual tip.

For driving screws use is made of a plain or ratchet screw driver. A pressure exerted on the handle drives the screw or removes it, according to how the mechanism is set by the button on the side of it. This is a great time saver where many screws have to be placed.



B

Fig. 8 A

Wrenches of various kinds are used to handle rods, nuts and the like, a Stilson wrench for handling pipe, etc., being very useful —also for fitting round rods of any kind.

Muriatic acid cut by dropping bits of zinc in it may be employed as a flux to solder iron with, but for soldering electrical joints on copper wires it should never be used, only the non-acid fluxes such as rosin, being permissible.

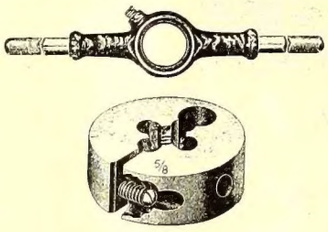


Fig. 9
Thread Cutting Die and Holder

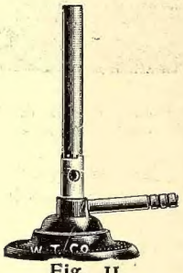


Fig. 11
The Bunsen Burner

Fig. 12 depicts a speed counter for taking the speed in revolutions of shafts, pulleys, etc. The speed of a belt driven shaft is dependent upon the proportion existing between the diameters of the driving and driven pulleys. Briefly expressed, it is as follows: The speed of one pulley, A, is equal to the product of the diameter of the other pulley in inches (say we call it B), by the revolutions per minute it makes, divided by the diameter of the pulley A, in inches, the result being in revolutions per minute (R. P. M.).

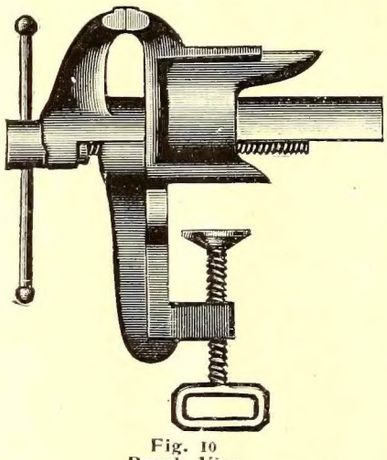


Fig. 10
Bench Vise

The speed ratio of gears is found by dividing the number of teeth on the large gear by the number of teeth on the smaller one. For example, suppose one gear had 100 teeth on it and the smaller one 12 teeth, then the ratio of speed would be 8 to 1, or the smaller gear wheel would make eight revolutions to every one of the larger gear. *(Finis.)*

PHOTOS OF MAGNETIC FIELDS.

An improvement on the method suggested by Mr. Hymes (February issue, page 148) for photographing magnetic fields is found in the use of blue-print paper in place of Velox.

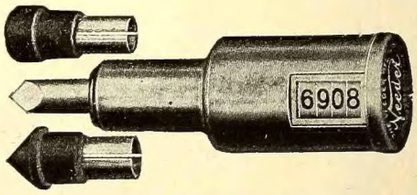


Fig. 12
Speed Counter

The blue-print paper is easy to manipulate, requiring only washing in water to fix the image, and is also not subject to fogging from premature exposure to ordinary sunlight. This makes its use more convenient.

When purchased in large pieces the paper can be obtained at 20 to 30 cents per yard, which is a very important item where a number of prints are to be made.

Contributed by S. KRAUSE.

INDIANA RADIO AMATEURS: ATTENTION!

I am trying to get on foot a plan to unite the amateurs of the 8th and 9th Radio Districts within 100 miles of Angola, Indiana. I wish all amateurs who are interested would communicate with me. Yours truly, Leo B. Wilcox, 415 W. Park Ave., Angola, Ind.

Interesting Experiments in Electricity

By P. Mertz

No. 1. An Electric Pump

THIS pump is a purely electromagnetic one, and although it is extremely weak, nevertheless it is very interesting as a curiosity.

Referring to Fig. 1, A is a tin can; almost any size will do very well. In the bottom of the can is put a disc (B) of mica, celluloid, hard rubber or any insulator which is not affected by being immersed in water. C is as powerful a bar magnet as can be procured; it is better if it is of circular cross-section, as it will not interfere so much with the motion of the water.

A solution of copper sulphate in water is to be poured into the can. The terminals of a fairly powerful source of current (D) are then connected, one to the tin can (A) and the other to the bar magnet (C). As soon as the current is turned on the water will be observed to begin to turn around the bar magnet. If little pieces of paper, wood, etc., are dropped in the water the motion will be more easily seen. If the direction of the current in the water is reversed the latter will turn in the opposite direction. With a strong bar magnet and current the water will rotate at a pretty good speed. If the water rotates very slowly, or not at all, due to the current not being strong enough, this can be remedied by using a can of less diameter, so that there will be less water to move.

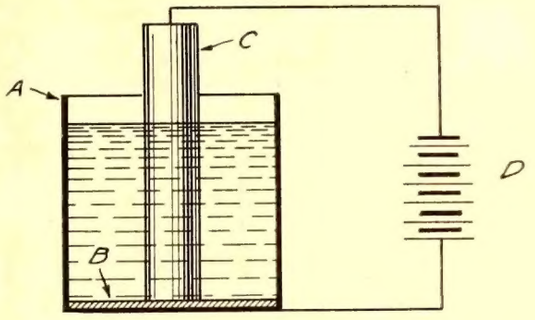


Fig. 1.

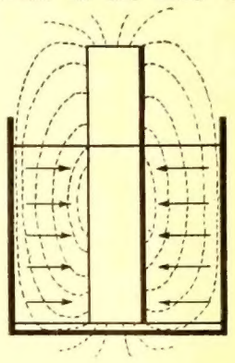


Fig. 2.

Diagrams Showing How a Copper Sulphate Solution Will Rotate Due to the Whirling Magnetic Field About a Conductor.

Although this apparatus is hardly worthy of its name as a pump, it is easily seen that the centrifugal action of the water as it rotates in the can suggests a somewhat more real pump.

The motion of the water can easily be explained from the diagram, Fig. 2. The current as it crosses from A to C encounters the magnetic lines of force of the magnet in such a way as to produce motion around the latter.

No. 2. A 500-Volt Dry Cell.

This dry cell, although having such an enormously high voltage, nevertheless occupies a space of only about 8x1½x1½ inches, and is as dry as the atmosphere which surrounds it.

It is made of a great number of thin paper washers about 1½ inches in diameter, painted on one side with aluminum paint and on the other with gold paint. As illustrated in Fig. 3, they are strung on a ¼-inch hard rubber rod, great care being taken to see that the aluminum sides of all the washers face one direction and the gold sides the other. The washers are compressed together between two metal washers, each under a nut screwed over the end of the hard rubber rod.

This forms a voltaic pile, the aluminum and copper faces, respectively, acting like the more usual zinc and copper discs, and the paper with the slight trace of moisture it gathers from the surrounding atmosphere, as the usual cloth wet with acidulated water. The extremely small amount of moisture is quite sufficient for generating the extraordinarily high (for a dry cell, at least) potential. The voltage of the cell can easily be tested if one end of it is grounded and the other touched to an electroscope. It will be noted, however, that the electroscope will take some time before deflecting, on account of the extremely minute current, which cannot charge it very rapidly. This current is so small that even a rather sensitive galvanometer cannot readily detect it, unless the diameter of the paper washers is quite large and they are quite moist.

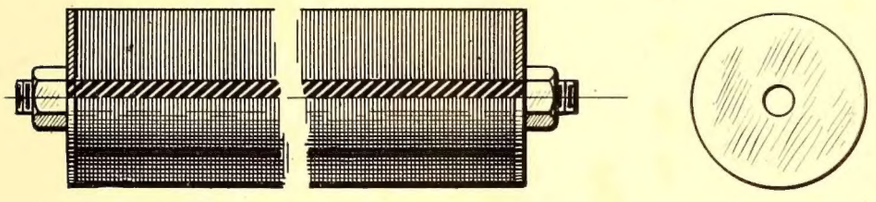


Fig. 3.

A 500 Volt "Dry Cell" Built on the Principle of the Voltaic Pile.

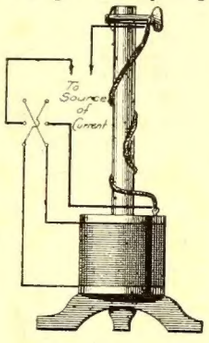


Fig. 4

No. 3. The Electric Snake.

This is simply an iron tripod stand of the kind used in physics experiments (as shown in the illustration, Fig. 4), over which a solenoid has been slipped so as to make a magnet of it. At the top end a clamp is fastened to hold one end of a very flexible conducting cord, the other end of which is fastened to a screw, or whatever is handiest, on the top wooden end of the solenoid. The cord is connected in series with the solenoid with a fairly strong current, and a reversing switch is inserted in such a way as to be able to reverse the current in the cord without affecting that in the coil. By turning the switch first one way and then the other the cord will coil around the iron support in a way strongly suggesting a snake. The current, however, has to be fairly strong to make this experiment successful.

Fig. 4 Shows an "Electric Snake" Experiment Easily Performed.

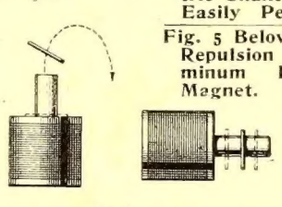


Fig. 5

Fig. 5 Below Depicts the Repulsion of an Aluminum Ring by a Magnet.

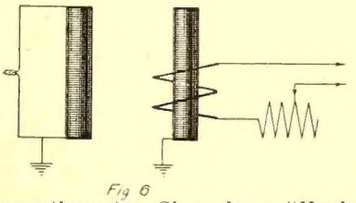


Fig. 6

In Fig. 6 Connections Are Given for a "Magic Light," Controlled by a Wave of the Hand.

No. 4. Experiments with Induction in an Aluminum Ring.

If a light aluminum ring is slipped over one end of a fairly powerful electromagnet, such as is illustrated in Fig. 5, when the magnet is energized the ring will suddenly take a jump either toward or away from the coil. If then the current is reversed the ring will jump in the opposite direction. If the magnet is held vertically, instead of horizontally, the ring will be able to jump in only one direction (i. e., upward), but the length of jump will be increased, due to lack of friction. Indeed, if a strong enough magnet is used the ring will have no difficulty in jumping right off the magnet and landing on the floor. The experiment will be far more striking if the core of the magnet is made of a bundle of iron wires than if it is made of a solid piece.

If the magnet is energized with alternating current the ring will float in a certain position without apparent support. If disturbed from that position it will very gently and gracefully come back to it.

These experiments are especially mysterious to most because the ring is of aluminum, a non-magnetic material. The explanation, however, is simple; it is merely that a strong current (due to its low resistance) is induced in the ring, and this current generates a magnetic field, which, reacting with the field of the magnet, produces the motion.

No. 5. The Magic Light.

On the table are intricate apparatus resembling a wireless set and a Tesla coil. A few feet away is another Tesla coil, minus its heavy coil of wire, the fine coil alone remaining. The two ends of this coil are connected to a very small pea incandescent lamp, not lighted.

The performer turns on the switches; still the lamp does not light. He says a few occult words and waves his hands mysteriously around, and, lo and behold, it lights up! With a few more magic words and waves of his hands he extinguishes it. He then offers to blow it on. He first blows hard at it, but it does not light up; he comes nearer, blows very gently and, yielding to his coaxing, the

lamp lights up! He blows again and the light disappears from the lamp.

The electrical man in the audience is much peeved. "There are connections under the carpet," he says. The performer offers to try the experiment standing on a big board placed on the floor. He then does the same things, without the slightest lessening of his magic powers.

Various members of the audience offer more or less ridiculous explanations, but no one guesses the true one.

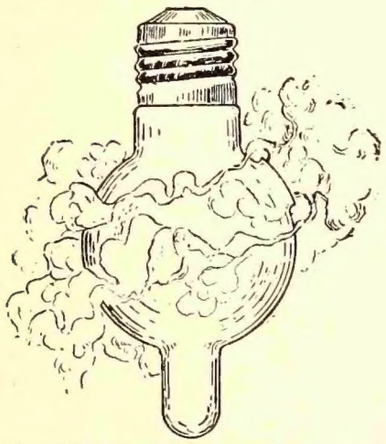
How did he do it? It is very simple. He had a Tesla coil rigged up with a tuning helix. The other Tesla coil was connected to the lamp, and one terminal of each coil was grounded. Just before the experiment the performer tuned the transmitter until the lamp brightened up, and then put in a trifle more inductance, just enough so that the lamp would be extinguished. Then he placed his hand near the receiver. The result of this was that the lamp circuit had more capacity than before, which raised its wave length and brought it in tune with the transmitter, lighting the lamp. When he waved his hands he brought them near the coil, and when he blew at the lamp he brought his head near the same coil. When he extinguished the lamp he merely moved away from the coil. No one ever guesses that the proximity of some part of his body to the coil has anything to do with lighting or extinguishing the lamp. When he got on the board he still had enough capacity to produce the desired effect.

The whole thing is so simple that any wireless experimenter who has a transmitting set can easily repeat it.

A NEW ELECTRIC VAPORIZER.

For deodorizing, fumigating and medicinal purposes there has just been put on the market a new electric device of extremely simple construction known as the *Vaporel*. It consists of a blown-glass bulb about the size of a 25-watt tungsten lamp and similar in general appearance, as the illustration shows. It carries a standard screw base, so that it can be used in any lamp socket.

The glass bulb carries two spiral electrodes placed about 1 inch apart, and the current completes its path from one electrode to the other, through the oil solution poured into the bulb through an opening provided. When the oil is entirely vaporized the device shuts off the current automatically, or as soon as the liquid drops below the shorter electrode.



Ingenious Electric Vaporizer, which Fumigates Room in Few Minutes.

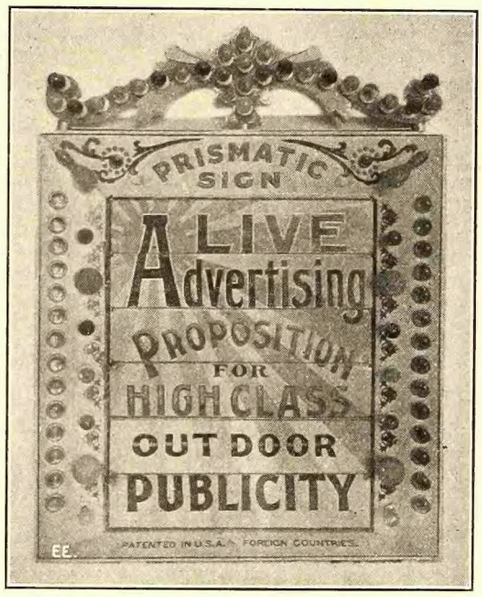
This simple vaporizing device has a wide field undoubtedly. It is recommended by physicians for inhaling or medicinal vapor treatment. Using the proper oil in it, the vapor will quickly kill the odor in kitchens, smoking rooms or any place where the air is befouled.

AN ELECTRIC MOTION SIGN.

By Frank C. Perkins.

The illustration shows a novel electric motion sign, operated mechanically and constructed of steel and iron, intended, when in register, to display a series of painted advertisements, they following each other at regular stated intervals, on a large, apparently unbroken display surface, which, in reality, consists of several separate and interchangeable parts. A unique feature obtained by this device is in that the exposed surface is made to disappear and is immediately replaced by a second surface, likewise composed of numerous units.

The change is effected very quickly and a series of four changes, following each other in regular rotation, are provided. These and other attractive results are attained by means of a series of prisms, each having four longitudinal faces and each carrying as many leaves, which are hinged to the edges of the prisms in such manner that when the prisms are at rest, all of the spaces between the prisms are closed by the leaves and the continuous surface presented alternately of prisms and leaves. The advertisement or advertisements cover the entire front surface and are, therefore, partly on the prism surfaces, and partly on the leaves.



Prismatic Electric Sign, Giving Very Spectacular Effects.

While the sign is in register for reading, there is a glare of white light brilliantly illuminating the advertisement. During act of changing from one advertising surface to another, while the white lights are off, various spectacular flash effects take place, each of the four changing periods varying in colored light effects.

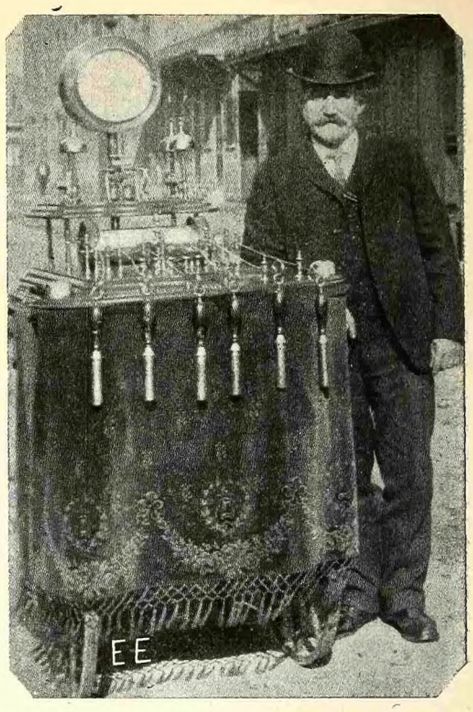
It is pointed out that the possibilities for beautiful illumination are unlimited with the mechanism of this device, and at a minimum cost. By means of lenses placed around the frame, a changing color scheme is presented with only a few lamps, having the appearance of many.

It is well known that *action* is an eye magnet. An ordinary sign 20 feet by 20 feet, contains 400 square feet of painting surface. The prismatic sign same dimensions, contains *four times* as much painting surface or 1600 square feet and occupies the *same* roof space.

The journals revolve on roller bearings, thus eliminating friction to a minimum, and in conjunction with a practical reduction gearing, it requires but a very small motor. It can be used as a two-way motion sign, showing advertising from opposite directions with same set of prisms and leaves, one side being painted on reverse side of leaves only, as leaves cover the reverse side of prisms. This gives 3,200 square feet of surface.

THE NICKEL-A-SHOCK MAN.

One of the many applications of electricity is that of giving shocks to the general public at 5 cents a shock. An outfit for the vending of such wares and its

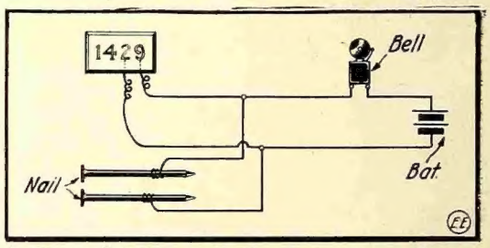


The Man Who Sells You Electricity at 5 Cents a Shock.

owner are seen in our illustration. This machine is familiar to those who live in New Orleans, and similar outfits are scattered throughout the country. A powerful-looking induction coil, appropriately trimmed up with polished brass balls and what-nots, serves to create a mysterious effect. A massive "current" gauge indicates how many "volts" are being taken through the handles shown.

SECRET CONTACT FOR CLUB BELLS.

When private clubs or houses desire a secret bell-ringing contact it is easily arranged for, as shown in our sketch. The two wires of the circuit are connected to any two metallic numbers on the house number, or the wires may be joined to two nails, et cetera. When the proper party comes along he simply short-circuits the nails or numbers connected to the bell circuit and the bell rings. Ordinary bell or annunciator wire No. 18 gauge is all right. A couple of dry cells and a 2½-inch gong bell complete the outfit. A knife or piece



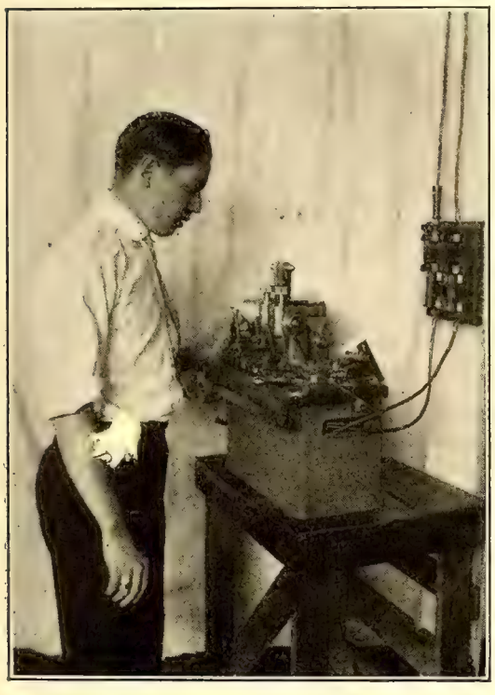
A Piece of Wire or Knife Blade Placed Across the Door Numbers, etc., Rings the Secret Club Bell.

of wire should be used to short the contact points on numbers.

RAPID ELECTRIC WELDING.

MACHINES of the butt welding type are now available for the manufacturer who has great quantities of one kind of work to weld electrically. They are not intended to replace the blacksmith where a variety of work is done, but on repeat work a boy with a welding machine can turn out more work than a dozen blacksmiths, and do it better, at a saving of anywhere from 60 to 90 per cent. in labor cost in many cases. Two pieces of metal are placed in the jaws of the welder, with their ends touching each other. The electric current is turned on and they instantly begin to heat. The boy operating the welder can see when the metal is white hot and begins to soften. He pulls a lever and forces the ends of the stock into each other. The metal is in full view of the operator at all times, instead of being concealed in the coal and flames of the "smithy's" forge. No smoked glasses or goggles are needed, any more than they are by the blacksmith. There is no scarfing to be done and, due to the way the metal is forced together, there is no oxidization, consequently no welding compound is required or used. The machine here shown is one of the Toledo Electric Welder Co.'s small machines.

This is not the case with fire welds, as the formation of scale due to oxidization, and the difficulty of applying the heat uniformly and welding quickly enough after taking from the forge, prevents the ideal conditions under which electric welds are made.

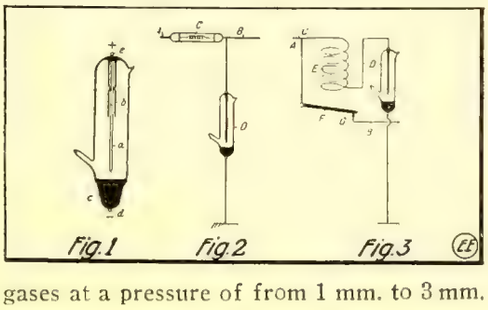


A Boy, with the Modern Electric Welder, Can Turn Out Remarkable Work in Quantity.

VACUUM TUBES FOR TELEPHONE AND TELEGRAPH LINE PROTECTION.

A very useful application of the vacuum tube was recently perfected to be utilized in telephone and telegraph line protection. Fritz Schroeter in the *Electrical World* describes a new form of vacuum tube which is effective down to 130 volts.

The construction is shown in Fig. 1. The anode (a) is an aluminum pin surrounded by a protective tube (b). The lower end of the anode (a) is at a distance of a few millimeters from the cathode (c) which is a fused alloy of potassium or sodium. Current is supplied through platinum wires (d) and (e). The tube is filled with a rare gas such as helium, neon, argon or a mixture of these gases at a pressure of from 1 mm. to 3 mm.



This tube may be used with connections of either Fig. 2 or Fig. 3. In Fig. 3 the telephone transmission line (A) is separated from the exchange line (B) by a relay consisting of three parts, E, F and G. When a dangerous voltage occurs a brush discharge takes place in the vacuum tube D because the high resistance of E (of about 8,000 ohms to 15,000 ohms) prevents the currents reaching an intensity sufficiently high for the evaporation of the cathode, which would produce an arc. The current passing through E excites the relay and attracts the armature F so that the contact between lines A and B is broken.

THE WOOLWORTH TOWER IN NEW YORK.

The tower of the Woolworth Building, a remarkable photo of which is shown here, is a veritable flaming torch at night, illuminated by the thousands and thousands of electric lights. The gilded surfaces of the mansard roof from the fifty-third to the fifty-eighth stories are turned at night into a glow of light which is even more picturesque than by light of day. Six hundred projectors, each containing a 250-watt Bryan-Marsh Mazda lamp of the new gas-filled type with closely contracted filament, in addition to the 24 1,000-watt lamps in the lanterns, help to illuminate the upper portion of the building, which houses over 30,000 inhabitants. The total power consumed is 175 kilowatts The installation required 50,000 feet of conduit from ½ to 3 inches diameter; 500,000 feet of No. 14 duplex wire were used. The reflecting characteristics of the glazed terra-cotta surface of the building and the necessity for mounting the large amount of equipment in a few restricted locations of the tower itself caused unusual difficulties in the design of the lighting scheme and equipment and in the installation features.

Photo (C) by Underwood & Underwood.
Beautiful Appearance of the Woolworth Tower, New York, Illuminated at Night. City Hall Park in Foreground. "Nickels and Dimes Built It."

LIBERTY BELL HEARD ACROSS CONTINENT.

The historic old Libery Bell, at Independence Hall, Philadelphia, which tried so valiantly to proclaim, far and wide, the joyful news of our declaration of independence, recently tried its voice again, and this time succeeded in making itself heard a thousand times further. Fitted under the bell was a telephone transmitter from the trans-continental line (it may be seen just below and in front of the bell), and when it was tapped with the mallet the ring of the cracked old bell was heard in San Francisco. A record of this historic event was made by a phonograph, seen in the picture, so that the tones of the veteran of Revolutionary times might ring down through the ages.

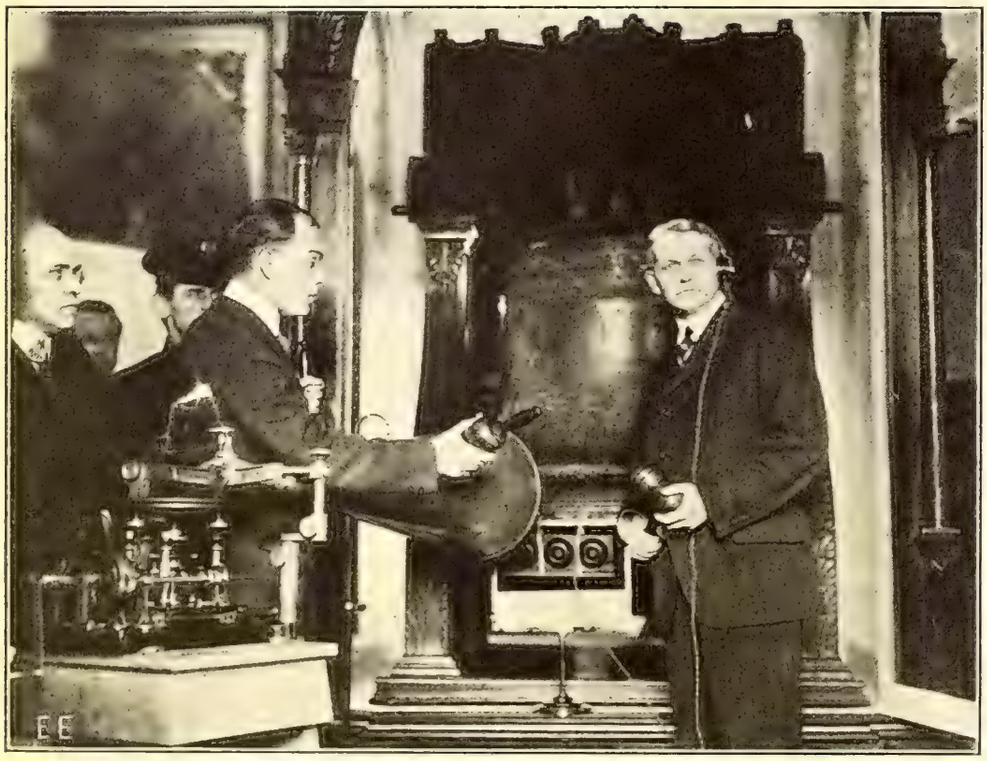


Photo (C) by Underwood & Underwood.

In the Recent Opening Tests of the Trans-Continental Telephone the Sound of the Liberty Bell Was Heard in Frisco. A Phonograph Also Recorded It.

ELECTRICITY IN NATURE.

(*Continued from page 5.*)

Why are lightning conductors attached to tall edifices, monuments, etc.?

Because they convey the electricity of the air and clouds *harmlessly* to the earth.

Why does copper form the best lightning conductors?

Because it has been found that electricity passes over a copper surface *more rapidly than over any other.*

Why do they convey electricity harmlessly to the earth?

Because electricity flies along their substance with great velocity; therefore it passes harmlessly away. It is only when its progress is *resisted* by a *non-conducting body* that electricity manifests *force.*

Do lightning conductors attract electricity?

They do not *attract electricity,* they merely afford it a *rapid conduction* when it happens to reach them. They no more attract electricity than water-pipes attached to a house attract water.

Why should a large building have several conductors?

Because elecricity may strike upon *any part* of a building. It is, therefore, proper to have several conductors, and to ramify their branches over the surface of the edifice, so as to form *a perfect system of conduction.* A ship having three masts, only one of which was protected, had her unprotected masts shattered, while the protected one remained untouched.

Why should the conductors terminate in earth?

Because then the electricity would be discharged from the conductors, and would have a *sufficient area of escape,* without creating a shock.

It is a good plan to attach the conductors to the gas-pipes in the earth, or to convey them to any body of water near the building.

BARON MÜNCHHAUSEN'S NEW SCIENTIFIC ADVENTURES.

(*Continued from page 3.*)

manner, luckily for me. Instead of which he uses a hollow needle and injects the embalming fluid into my veins. I am a sound sleeper. A very sound sleeper. Suffice it to say I did not wake up for a long time. As time goes, a rather very long time. To be accurate, I did not wake up for 110 years. It seems the embalming fluid that Rosskopf used on me was a good brand, for it did not wear out for 110 years, i. e., till A. D. 1907. It seems that this embalming fluid made my body rigid and stiff like stone, and to all intents and purposes, unknown to me, I was as dead as my wax replica, which they had buried the same afternoon. However, it seems my heart had continued to beat faintly through all these years and the prolonged rest, instead of aging my body, really made me younger. Although technically I am to-day almost 200 years old, I really feel like 30. You see what a good rest does! The next thing I knew was when I finally woke up and sneezed about 10 times. I was still on my bed in my secret room!

"You ask how it can be possible. Simplicity itself. Only Fritz and I knew of the secret room. Rosskopf, the embalmer, when he became sober again had promptly forgotten all about it, of course, so he really did not know any more than anyone else.

"As I found out afterward, this is what happened: Fritz, my trusted valet, had gone over to the burial vault to lock up the heavy oak door. But it seems that the door snapped shut while he was inside of the vault. As I lived alone with him, there was no one to release him but me, and he naturally thought I would miss him in time when I would, of course, release him. I did so—in time—110 years after! Poor fellow. I cried a bit when I saw his bones.

"But to go back. I said I woke up trying to sneeze my head off. For a few minutes I could not see anything for the dust I made while sneezing. I got up and felt rather stiff, and hungry as a bear. I opened the window and looked out. The strange sights I saw there fairly made me dizzy. It took me some hours to get used to it all; to make a long story short, it finally dawned on me that I must have slept for years. In the afternoon I cautiously walked down and inspected the house, which looked to me the same as on the day I went to sleep. I then ventured out in the neglected, unkempt garden, and after satisfying my hunger by means of a few dozen pears, I sat down on a decaying bench to think about the strange situation. While I was pondering about it I noticed a sheet of printed paper on the ground. It proved to be a part of a recent Hanoverian newspaper. I picked it up casually and tried to read the somewhat unfamiliar type. Suddenly I saw the date: September 29, 1907! It was then—for the first time in my life—that I fainted dead away; the shock was too great.

"But your time is limited, my dear boy, so I will make it short. Suffice it to say that after I came to I went over to the city hall and explained the whole affair to the Herr Bürgermeister—our mayor. I had no trouble of proving my identity, and the dear fellow overwhelmed me with kindness. He fêted and dined me and insisted that the town of Hanover should give a fitting celebration in my honor, but this, however, I declined modestly. In the course of the dinner he told me that, due to all good traditions of German official red tape, my house and estate were still in the process of liquidation, as I had neglected to leave a will. So I went and filed my will that very day and my lawyers assured me that, as I could prove my identity without doubt, I should be able to inherit my own estate within at least 25 years. They further assured me that I need have no misgivings as to my political offenses which I committed 110 years ago; they argued that these offenses had been outlawed. That took a big load off my mind. Well, I guess we've chatted long enough for to-day, besides my power is getting low. . . ."

"But, Your Excellency," I shouted back into my transmitter breathlessly, "won't you please explain how you come to be on such an outlandish place as the moon, and if you are there, how can you exist, for there is certainly no atmosphere on the moon and the temperature is below zero. . . ."

"I would gladly tell you all this now, but it takes time to explain these things," it came back very weak and distant, "but as I said before, my power is getting low, so if you will be at your 'phones to-morrow night at 11 p. m., terrestrial time, I will gladly satisfy your curiosity. Good night!"

(The next story is entitled: **How Münchhausen Took Berlin with the Allies.**)

A wireless station often contains enough fine wire to reach the distance it signals over. No "right of way" expense occurs though, or pole line cost either.

The mighty 42-centimeter siege guns of the Germans are fired by electricity, as also the large howitzers.

A Small Rotary Converter and Synchronous Motor

AS many electrical experimenters have great difficulty in obtaining at small cost a low voltage direct current supply to charge storage batteries, operate spark coils, motors and other apparatus, they will find the following very efficient:

The shunt-wound direct-current dynamo of the 8 volt, 10 ampere type, used in conjunction with step-down A. C. transformer, and an adjustable rheostat will be found very superior for this purpose.

The alternating current voltage should be a little lower than that of the dynamo at 3,600 revolutions per minute. Higher frequencies than 60 cycles cannot be used very well. Lower frequencies require less speed.

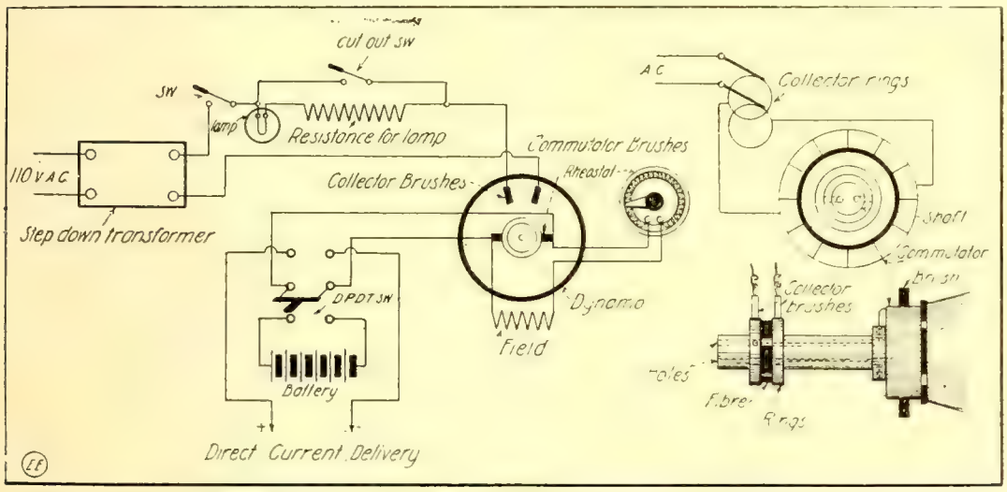
Two insulated collector rings of brass or copper are required on the shaft. A good place for these is between the commutator and the windings. They are connected to two opposite segments of the commutator (see drawing). Two brushes of springy copper or copper gauze, the holders of which are insulated from the frame with mica or fiber, are used in connection with the rings.

The dynamo should be brought to a speed of 3,600 revolutions per minute before connecting with the transformer. This may be done with dry batteries and varied with the rheostat in series with the field. When the desired speed is attained the switch which cuts in the synchronizing device may be thrown in. This device is a lamp of very low candlepower, equal to the voltage of both transformer and dynamo. If the candlepower is high the batteries may not be able to bring the motor to the desired speed, in which case a tungsten flashlight lamp with resistance in series is the best to use. Care must be taken to have sufficient resistance for the combined voltage of the transformer and dynamo to limit the current. The lamp should light up bright and go out, alternately, and while the light is out the switch which short circuits the synchronizing device (see drawing) may be thrown in and the batteries taken off. Direct current may then be taken from the commutator brushes.

If batteries are not available a hand drive may be used. In some cases the lamp may burn dim and continue so when the batteries are not strong enough to overcome synchronous speed. Then the short-circuit switch may be thrown in at any time and the batteries taken off.

This dynamo may be used to convert direct current to alternating current, the frequency varying with the speed, the direct-current supply being connected to the commutator brushes and the alternating current taken from the collector brushes and rings. This converter can also be used as an alternating current motor of unvariable speed, known as a synchronous motor, which is very desirable for driving rotary spark gaps in wireless stations, talking picture devices and many other purposes and applications.

Contributed by H. STEPHAN.



Simple Scheme for Making Any D. C. Dynamo a Synchronous A. C. Motor or Rotary Converter.

HAND-DRILL COIL WINDER.

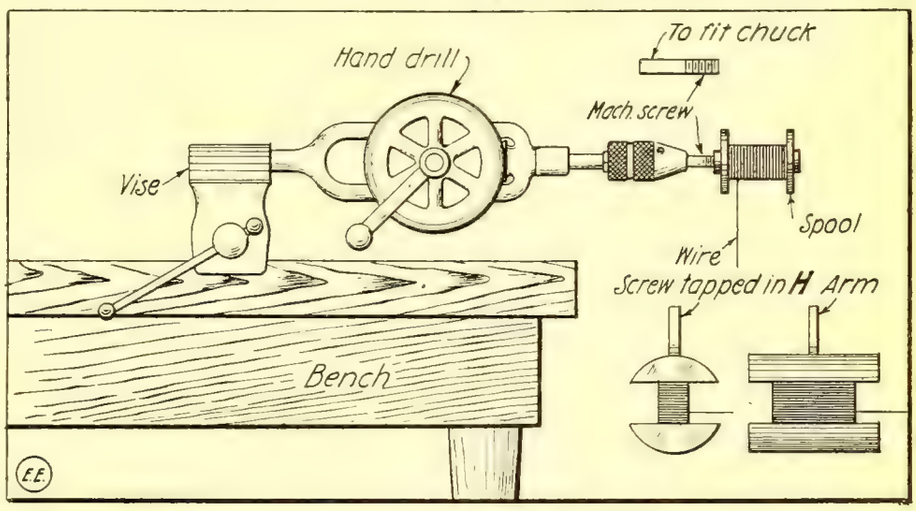
I made a very simple and durable winding machine from a hand-drill.

I clamped the hand-drill in the vise by the projection of the bearing of the large gear at the back of the drill; then clipping the head off of a machine screw that would fit the magnet I wished to wind. I then fastened it in the chuck, screwing the magnet core on this and proceeded to wind on the wire by turning the handle.

Afterward I wound the bell coils of a telephone and the "H" armature of a telephone generator in the same way. On the armature I had to thread one of the holes with a tap wrench and tap.

Submitted by

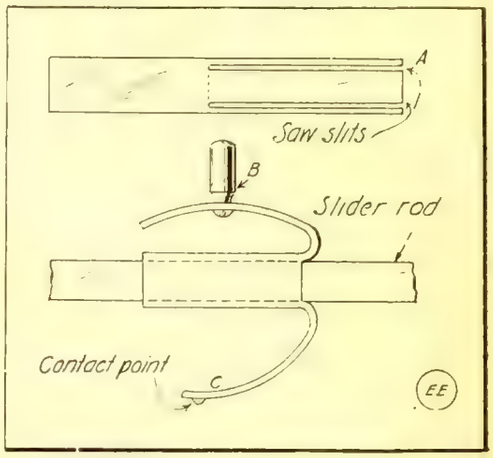
L. N. STUART.



Showing How to Wind Magnet Coils, Shuttle Armatures, etc., with Ordinary Hand Drill in Vise.

TUNING COIL SLIDERS.

I have had great trouble with sliders for tuning coils. I have had success with the style I am going to describe. The greatest trouble is making the contact strip and fastening a handle. To make one proceed as follows:



Simple Rheostat or Tuning Coil Slider Made from Piece of Square Brass Tube.

Get a piece of square brass tubing about 3 inches long and large enough to slip over the rod easily With a hack saw slit it down 1½ inches (at A); then bend back and cut the remaining part out. Now drill a 11-64-inch hole (at B). Next, with a center punch, make a small dent (at C). An ⅛-inch 8-32 screw passes through the upper limb as a fastening for the handle.

Submitted by EDWARD MINNIS.

RADIO-CRYSTAL SENSITIVITY.

B. Hoyle referred to experiments carried out in order to ascertain the effect of frequency on crystal sensitiveness in a recent talk at Liverpool, Eng. Carborundum, which was known as a definite rectifier of oscillations, and perikon and radiocite, which were thermal in action, had been investigated and found to be very constant over a range of frequencies varying from 100,000 to 1,500,000 per second. Regarding the thermal action on low oscillating currents changing to valve action for large currents, experiments carried out by the speaker had shown that up to 12 or 14 microamperes the ratio of current in one direction to current in the other was unity, but above this value the ratio gradually increased to three or four to one.

The telegraphone records telephone speech by magnetizing a moving iron wire.

WRINKLES — RECIPES — FORMULAS

Edited by S. GERNSBACK

Under this heading we will publish every month useful information in Mechanics, Electricity and Chemistry. We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

FORMULA No. 9.
Cements for Work Shop.

Leather Belting Cement.—Take 1 part of *Common Glue;* 1 part of *American Isinglass.* Place them in a boiler and add water sufficient to just cover the whole. Let it soak 10 hours, then bring to a boiling heat and add pure *Tannin* until the whole becomes ropy or appears like the white of egg. Apply it warm. Buff the grain off the leather where it is to be cemented, rub the joint surfaces together; let it dry for a few hours, and it is ready for use. It will not need riveting, as the cement is nearly of the same nature as the leather itself.

Cementing Brass to Glass.—16 parts of *Copal Varnish;* 5 parts *Drying Oil;* 3 parts *Turpentine;* 3 parts *Oil of Turpentine;* 5 parts *Liquid Glue;* 10 parts *Stucco.*

Cement for Glass and Porcelain.—1 part of *Casein;* 6 parts of *Sodium Silicate.* Dissolve; apply at once and dry in the air.

Chemical Cement.—Mix together 5 lb. of *Resin;* 1 lb. of *Wax;* 1 lb. of *Red Ocher;* 2 oz. of *Plaster of Paris.* Melt the whole with moderate heat.

Cutler's Cement.—4 parts of *Resin;* 1 part of *Beeswax;* 1 part of *Plaster of Paris.*

Electrical Cement.—5 oz. of *Resin;* 1 oz. of *Beeswax;* 1 oz. of *Red Ocher.* Dry the ocher on a stove. Melt the wax and resin together and stir in the powder till cold. Best cement to fasten brass on glass tubes, etc.

Iron Cement.—7 lb. of *Iron Borings;* 2 oz. of *Sal Ammoniac;* 1 oz. of *Sulphur; Water* in sufficient quantity.

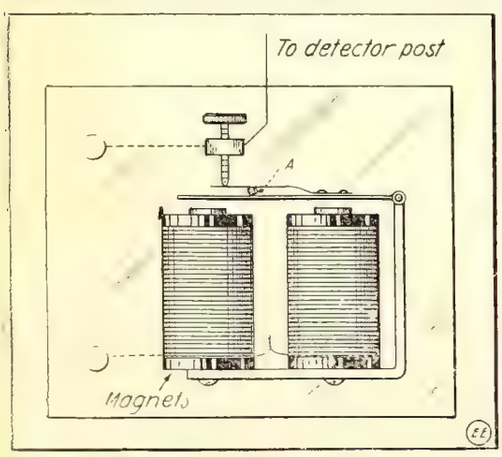
Stone Cement.—25 parts of *Linseed Oil;* boil with 35 parts of *Litharge* and 250 parts of fine powdered *Burned Lime.* Use hot.

Waterproof Cement.—1 part of *Glue;* 1 part *Black Rosin;* ¼ part *Red Ocher.* Mixed with least possible quantity of *Water.*

Cement for Wood.—Melt in an iron pan 1 oz. of *Resin;* 1 oz. of pure *Yellow Wax,* and stir in 1 oz. of *Venetian Red.* Use while hot. When cold it is as hard as stone. S. G.

MAKING THE BUZZER HY-TONED.

Some amateurs may be troubled by the harsh tone of the buzzer test. I remedied



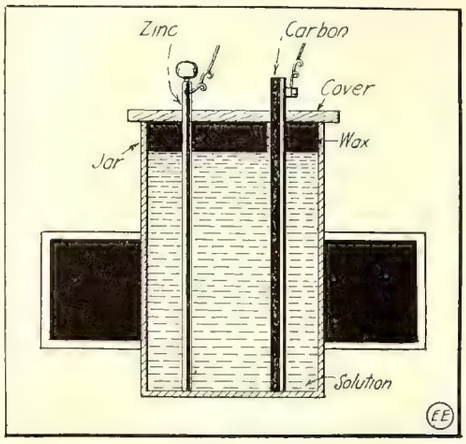
A Piece of Match "A" Between Armature and Spring Gives Hy-note.

this trouble in a simple manner, and the buzzer now sounds as good as the navy type. Secure a piece of match stick (a) about ⅜-inch long and pry it between the little piece of metal that is fastened on to the vibrator proper and the vibrator. It will be found that the note of the buzzer is increased in this way considerably.

Contributed by
ALEXANDER BOLLERER.

A SIMPLE BICHROMATE CELL.

A very simple bichromate cell can be made as follows: Place an ordinary car-

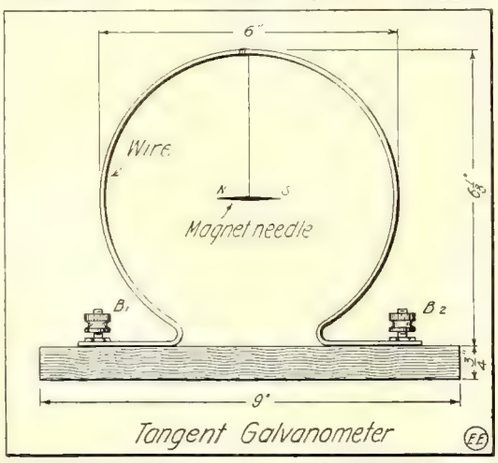


A Powerful Battery for Experimental Work.

bon rod and a circular zinc rod into a jar, as shown in illustration. The electrolyte consists of a mixture of one part of potassium bichromate to two parts of concentrated sulphuric acid, and the rest water. The cover and top of jar should be well coated with paraffin. Care should be taken to remove the zinc rod from the solution when the cell is not working. This cell is excellent for running motors and spark coils.

HOW TO MAKE A TANGENT GALVANOMETER.

Procure a wood base 3x6x¾ inch and on it drill two holes for the binding posts B1 and B2. Then take a piece of copper



Galvanometer Made of Loop of Wire and Magnetized Steel Needle.

wire or rod about ⅛ inch in diameter and nearly 22 inches long and bend it so as to make a circle 6 inches in diameter. Before doing this it is better to hammer the ends down flat, but do not drill the holes for the binding posts until you know where they come to. Next set this up on the base with the binding screws, which act both for connection of the electric current and support.

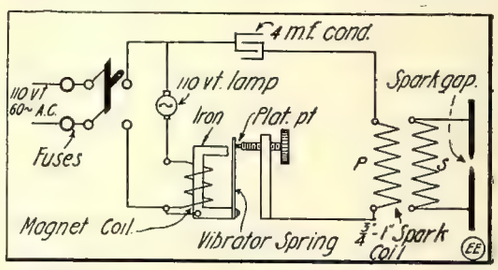
Next magnetize a steel sewing needle and tie a piece of fine thread (preferably a fine strand of silk) to the center of it and tie the other end on the top of the circle so as to let the needle hang in the center.

The coil can be made of several turns of No. 18 D. C. C. bell wire, etc., and the magnetic effect on the needle will then be greatly multiplied.

Contributed by CHAS. ANSLEM.

UNIQUE A. C. OPERATION OF SPARK COILS.

A very novel arrangement for operating ¾ to 1-inch spark coils directly from 110-volt 60-cycle A. C. circuit which has been used considerably in practise is shown in the accompanying diagram. As will be seen, a vibrator is utilized, which has a laminated sheet-iron frame, U shaped with a thin piece of clock spring as an armature, secured to the longer leg of same. A coil of wire is wound on the central leg of the iron core, and the alternating current, passing through this coil and a 110-volt lamp, sets up a rapidly fluctuating or alternating magnetic force in the iron. This force, acting on the vibrator spring, manages to interrupt the contacts regularly, the same as any other vibrator used on spark coils. One of the most novel features of this arrangement lies in the fact that the spark coil primary P is connected in series with a 4 M. F. tinfoil and waxed paper condenser, such as used in telephone work, as indicated. The coil thus derives just sufficient



Efficient Way to Operate Spark Coil on A. C.

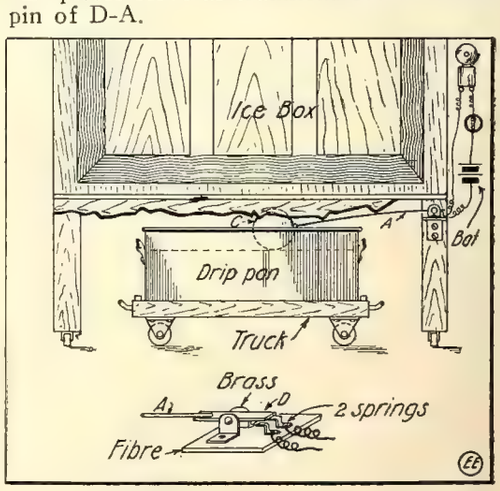
current through this condenser, which is of considerable capacity, viz., 4 M. F.

A DRIP PAN ALARM FOR ICE CHESTS.

I wish to make a contribution to your magazine in the form of a "Drip Pan Alarm," which I believe will be in demand in nearly every home.

Its construction is very simple and the illustration makes it all very plain. All that is needed is an electric bell, wire, batteries, an empty condensed milk can and a slender stick or brass rod about ⅛ inch diameter. The bell is fastened on the side of the ice box and connected with the batteries as shown.

The milk can C is sealed up to act as a float at the end of rod A. The other end of A is threaded in a swivel piece D. This in moving downward makes contact across the two brass springs shown, which are mounted on the fibre base plate. Two brass "L" pieces serve as trunnions for the shaft pin of D-A.



Simple Ice Box Drip Pan Alarm.

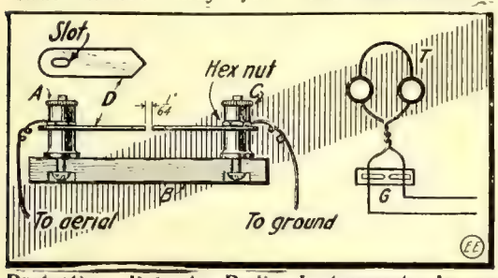
As the drip pan gets full of water the float C rises and eventually closes the bell circuit through the springs.

Contributed by
WILLIAM WARNECKE, Jr.

RADIO RECEIVER PROTECTIVE GAP.

A very simple method of protecting wireless receiving sets and also the expensive and delicate telephone receivers is indicated by the small spark gap shown in the sketch.

This gap is made up simply from a couple of pieces of ⅛x⅜-inch sheet brass, etc., having the two abutting ends pointed. A couple of binding posts of telegraph pattern are mounted on a base B to support the two spark gap electrodes D. The gap is made very short when same is set, or about 1-64 to 1-100 inch. It is common in a great many stations, including commercial and other stations, to connect one of these gaps across the aerial and ground leads where they join the instruments



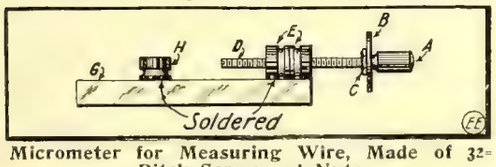
Protecting Delicate Radio Instruments by a Small Spark Gap.

proper, and also it is very advisable to place one of these gaps across the telephone receiver cord terminals as shown in the diagram, T being the telephones and G the protective gap. Any heavy static discharges coming down the aerial will thus jump these gaps and proceed to earth without affecting the instruments at all. Such static discharges will take the shortest path via the gap in preference to the high impedance circuit through the 'phone windings.

A CHEAP MICROMETER.

The drawing shows how to construct a micrometer which gives fairly accurate results, and it is handy to measure thickness of glass for condensers, etc. At G is a piece of ¼-inch-square brass rod. At E are two brass thumb nuts from an old, dry cell, soldered to G. C is a hexagon nut, tapped 8-32. H is a brass thumb nut from dry battery and soldered to G, called the anvil. The screw D is taken from a dry cell and should have 32 threads to the inch. B is a washer and should have four notches filed in the edge. By unscrewing the screw one full turn from the anvil H you get 1-32 inch; one-half turn, 1-64 inch, or two full turns, 1-16 inch, etc. A is an electrose knob.

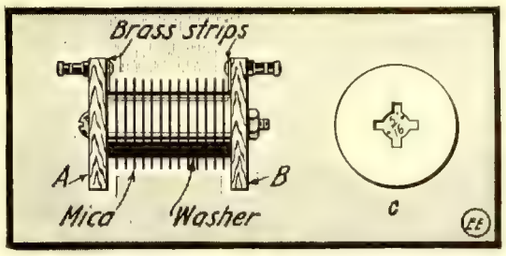
Contributed by DONALD HARDING.



Micrometer for Measuring Wire, Made of 32-Pitch Screw and Nuts.

A QUENCHED GAP FOR SPARK COILS.

The following is a description of a quenched gap which I have used successfully on my 1½-inch coil. The main idea may be obtained from the sketch. The end pieces, A and B, are of ¼-inch fiber, 1½ inches square. A 3/16-inch hole is bored through the center of each and another on corresponding corners. A 1½-inch bolt passes through the center holes and is taped on the inside to such a diameter that a washer having a 5/16-inch bore will fit closely on it. The length of the thread will depend on the number of plates used in the gap. Six or eight pieces of mica are then cut to the shape shown at C. Binding posts are placed in the corner holes and connected to the end plates with brass or copper strip. The mica rings and washers are then placed alternately upon



Simply Made Quenched Spark Gap.

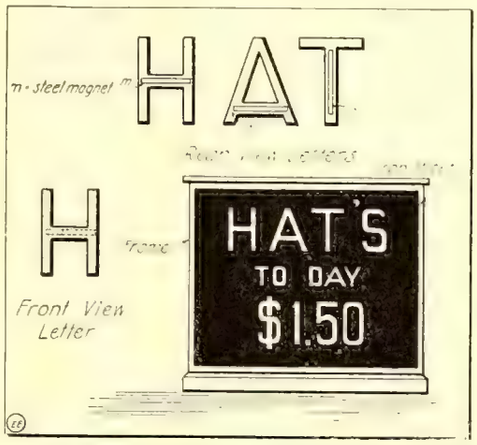
the mica or oiled linen tape and the whole fastened together securely by means of the center bolt. The spark obtained with such a gap, although not of high frequency, is musical and produces a pleasant note in the phones.

Contributed by J. W. HALLIGAN.

MAGNETIC LETTERS FOR WINDOW PLACARDS.

For rapidly and efficiently making up show-window signs or placards the latest conceit is magnetic letters, as shown in this illustration.

Expert window trimmers say that no show window is complete without a placard. But in windows in which the displays are changed often the expense for painting window placards is generally a considerable item in the advertising account. In fact, some electric companies pay from $3 to $7 a week for the painting



Window Placard Letters with Magnets on Them Enable One to Quickly Make Any Sign Desired.

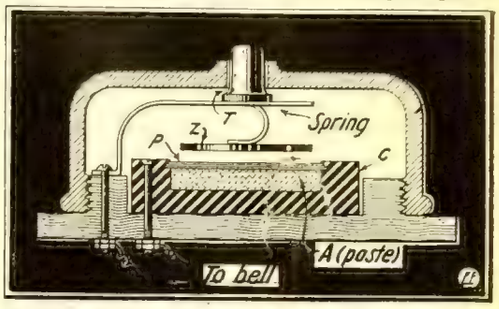
of cards with catchy phrases, which they claim supply a finishing touch to their displays. The letters used with these magnetic signs consist of metal patterns faced with heavy baked white enamel. To the back of each letter is attached a small permanent steel bar magnet about ¾ inch long. The backgrounds for these letters are made of iron of such thickness that it can be handled easily and can, to enhance its appearance, be placed in picture frames of narrow but neat design. When a placard for a window is wanted it can be made at a moment's notice with this outfit by placing the letters in any desired position against the black iron background, the small bar magnet holding the letters in place. With this system the placard wording can be changed as often as is desired without additional expense. Any form of wording layouts is thus available to the window decorator. No current is used by the device, so the only expense is the initial cost.

Electricity now pulls the boats through the Panama Canal.

MAKING A PUSH BUTTON BATTERY.

What would you think if you saw an ordinary-looking push button connected to a bell with two wires, no battery in the circuit, and upon the button being pressed the bell operated vigorously? The answer lies in the combined push and battery button illustrated in the diagram. Instead of two simple brass springs in the button cover there is a circular carbon block C, together with some blotting paper P and a small circular piece of zinc sheet Z. The button T presses down Z against the treated paper P, paste A and carbon C, thus forming a battery.

The blotting paper is first treated or saturated with a solution made of equal parts



A Push Button that Rings a Bell without Any External Battery.

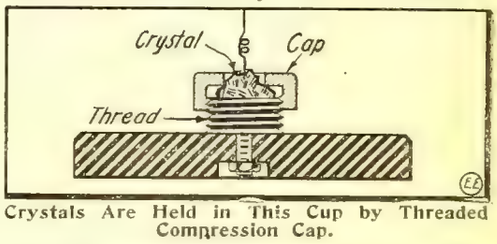
of chloride of zinc and cooking salt. The paper is cut slightly bigger than the opening in the carbon block, so as to be held in place properly. In the circular recess under the blotting paper is placed a stiff paste made up as follows:

Two parts pulverized asbestos; 10 parts mercuric ammonium chloride; 3 parts cooking salt and ¼ part of chloride silver. Melt all parts together, and after they have cooled sufficiently they are pulverized. Then mix up a stiff paste by adding slowly chloride zinc and water. Fill the carbon recess A full of this paste. The zinc plate Z should be about 1¼ inches or larger in diameter, and the carbon in proportion.

This battery push button is capable of giving 1.6 volts, and will last four or five weeks or more on one charge of prepared blotting paper. This considers that the casing fits tightly to keep the battery chamber practically air-tight. Such a device is useful in many ways besides its "magic" effect on the uninitiated, who will hardly suspect that such a small device contains a battery.

A SOLDERLESS DETECTOR CUP.

This detector cup has been designed for the purpose of eliminating the use of a low temperature alloy and to enable a



Crystals Are Held in This Cup by Threaded Compression Cap.

quick change of crystals without changing the cup. There are two parts—the base on which the crystal stands and the shell which covers the crystal. The base is a circular piece of metal one inch in diameter and threaded on the side all the way around. There is a threaded shank on the bottom by which the cup is held to the detector base. The second part of the cup is a brass shell or cap to fit over the base and screw down on the mineral. It is threaded on the inside to fit the threads on the base. There are corrugations around the side of the shell or knurl to give a better grip.

Submitted by GODFREY RIGBY.

WIRELESS DEPARTMENT

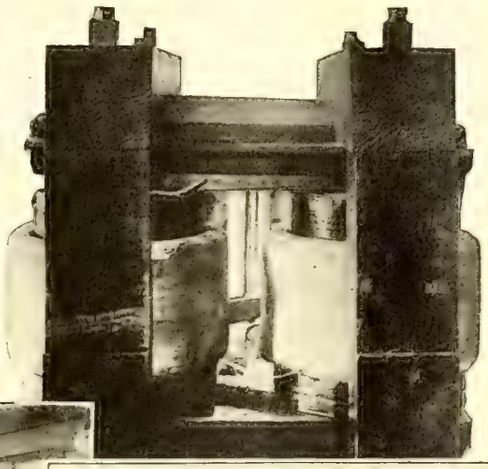
Wireless Telephony and Telegraphy on Union Pacific Railroad

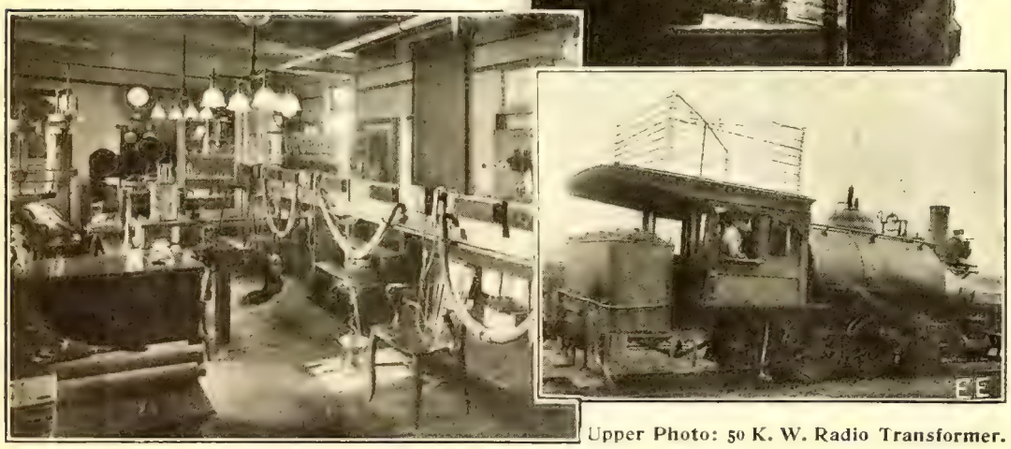
By Frank C. Perkins

THE accompanying illustrations show the electrical laboratory and railway equipment for work on wireless telegraphy and telephone service, which has taken place on the Union Pacific at its shops and headquarters, through the efforts of Dr. F. H. Millener, the wireless experimental engineer of that railway system.

Dr. Millener has made some interesting experiments on the Union Pacific Railroad in the line of communication between trains, and between stations and trains, by wireless telegraph, wireless telephone, and by wire. He points out that "the commodity most in demand in the world to-day, and that which the world will pay the highest for, is speed. The second is safety, as safety lowers the price to be paid for speed, and any instrument or thing which will add to these two great commodities must have a value to mankind." The elevation at Omaha is 1,200 feet, gradually rising until an elevation of 8,000 feet is reached at the summit of Sherman Hill, Wyoming. In planning for wireless telegraph stations this elevation has to be taken into considertion.

It is pointed out by Dr. Millener that another thing which enters very closely into the consideration of the subject is static electricity. In summer the static electricity between Green River, and Cheyenne, Wyo., and Sherman Hill, Wyo., causes all sorts of disturbances with block signals, burning them out, and occasionally putting the wire telegraph out of commission. Therefore, as a result of experiment, it was decided that the induction coil method of generating wireless impulses, or waves of the 60-cycle, alternating current variety, would not be satisfactory; for, even if nine messages out of ten were received properly and the tenth not so, fate would in all probability make that message the most important one.





Upper Photo: 50 K. W. Radio Transformer.

Left-hand Photo Shows Union Pacific R. R. Wireless Laboratory. To the Right Dr. Millener's Aerial Scheme for Locomotives.

It is stated that various schemes were tried, but it was found that the best results could only be secured by using a higher frequency than 60 cycles. Therefore, for the stations at North Platte, Neb., and Green River and Cheyenne, Wyo., it was planned to use a frequency of about 550 cycles transformed up to about 12,000 volts in an open core transformer, with a 5 kw. generator at Cheyenne, a 5 kw. at North Platte, and a 10 kw. at Green River.

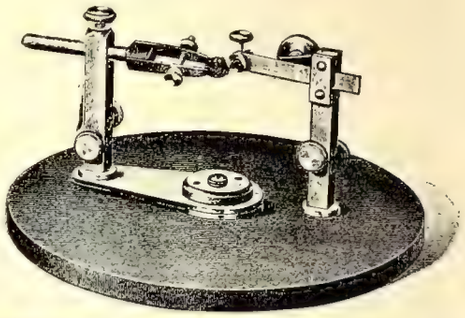
The station at Cheyenne is to work at all times, day or night, at least as far East as Omaha, and we hope an equal distance the other side of the mountains. The four stations—Omaha, North Platte, Cheyenne, and Green River—will thus work together at all times, and in all conditions of weather. In the telephone receiving the message from a high cycle, high frequency station, it is a high pitched note, similar in character to the sound of a tuning fork at 1,020 vibrations per second and is much pleasanter to listen to than the old 60-cycle low note. The sound also being high in pitch is not confused with static electricity; thus one of the greatest difficulties of the earlier wireless investigators is done away with.

As to aerials, or antennæ, it is said that in railroad work it is absolutely necessary to have the antennæ close and compact. In the first installation of the wireless telegraph station it is important not to complicate matters and to make the antennæ simple and easy to repair.

It is urged by Dr. Millener that the present tendency is toward using complicated apparatus and that this is not necessary; the simpler the better. It had been found that the use of the flat-top ships' antennæ is more practical than the umbrella type at stations, and parallel to the track, elevated by two self-sustaining towers, the height of which should be at least 210 feet and should be constructed to stand a wind stress of 90 miles per hour, at least, as we are building the wireless to work, when the wires go down.

A NOVEL DETECTOR STAND.

In the illustration here given is shown a novel radio detector stand, suitable for most any crystals, such as carborundum, galena, and silicon. It has a rotative arm,



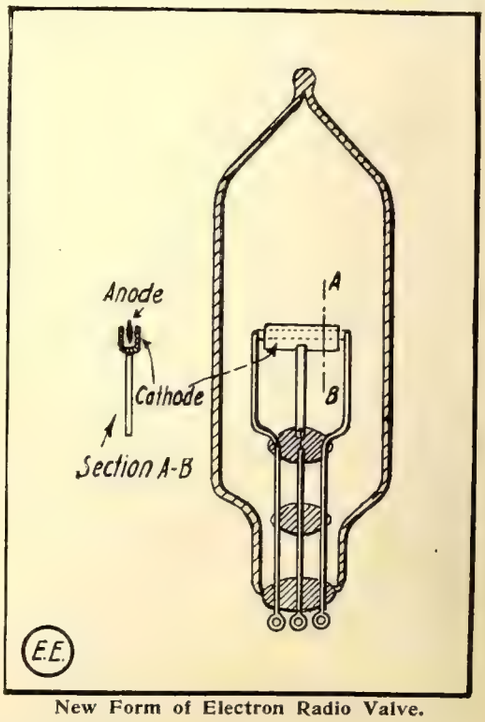
Carborundum Detector with Clamp Mounted on Rotatable Arm.

pivoted at the center of the base, which arm carries at its outer extremity an upright. This supports a sliding rod, having at its end a "drawing pen" type of crystal clamp.

A graphite or metal point is fitted adjustably on the other upright arm. Hence, most any adjustment desired can be obtained with this simple, yet ingenious, device.

A NEW WIRELESS VALVE.

The action of the kathodic detector or valve is based upon the peculiarity of hot, glowing bodies to send out negative emissions, which make it possible to ionize the space between the two electrodes of the detector. This makes it possible to use the valve as a wireless detector, for the reason that the received alternating currents and other very weak electromotive forces will be changed into uni-directional currents. The more powerful the emissions are, the more sensitive such a valve will be. The new Holweck valve recently invented has a kathode or a single metal piece whose sur-



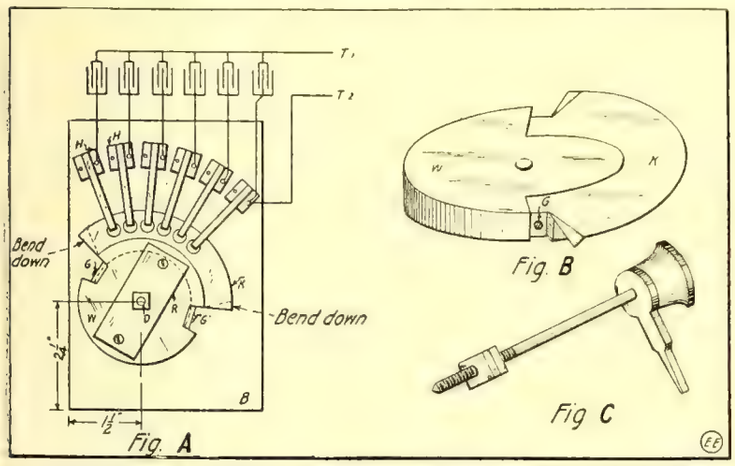
New Form of Electron Radio Valve.

face is ten times as great as those that have been used heretofore in the audion type valve. Furthermore, this surface is covered with a certain oxide which has been found as being quite necessary for the action. The distance between the anode and kathode is reduced to 0.1 millimeter; on account of this very small distance between the anode and kathode, one obtains a very strong and sure action. It is, furthermore, not necessary to take any of the ordinary cautionary measures during the operation of the valve. The temperature of the kathode must be capable of being regulated, and the anode is placed in series with an electromotive force the same as in other valves.

This new valve has been used with great success at the Paris Eiffel Tower and at the Arlington station.

VARIABLE CONDENSER SWITCH.

It is invariably the lack of adjustable condenser capacity that causes the harmful sputtering and sticking at the vibrator contacts of spark coils, run on a fairly heavy current. Furthermore, the



Condenser Switch, Acting by Moving a Metal Disc Successively Under Metal Strips.

stumbling block in making a variable condenser is the switch. The following is a description of an efficient variable switch that is easily made.

The materials needed are usually lying about any experimenter's workshop. Procure a piece of sheet-copper or brass about 6x3 inches; half dozen brass-headed tacks; an old watch spring, about ⅛" wide; a piece of ⅜" board, 4x6 inch; an oblong piece of 1/16" brass, 1x2¼"; and an ordinary spool from magnet wire.

Fig. "A" shows the bottom view of the switch, with condenser connections for six variations. Figs. "B" and "C" show the three parts of the switch detached.

"B" is the base, showing the six-clamp contacts at H—H. To make this part, take the piece of ⅜" board, 6x4 inches, and drill in it a 3/16" hole for "D", Fig. "A" 1½" from one side and 2¼" from one end. From center of "O", with radius 3¼", describe an arc. This will form the outer boundary of the springs at H—H.

To make the clamp contacts, first break off six 1¾" pieces from the watch-spring. Cut 6½" squares from the copper plate, and, with large shears, clip off the heads of six brass-headed tacks. On one end of each piece of spring solder one of the copper squares; on the other end, a brass tackhead. Of course, the soldering is done on the concave side of the head. A good plan is to clamp the springs down, tack heads and copper squares in position, and to drop solder on each end. When the soldering is finished, plunge the springs into cold water to retain the temper of the steel. Screw these clamp contacts down as shown.

Fig. "A" shows the upper side. To get the wooden wheel for this part, saw off one end, "W", of the spool. Nearly opposite each other (about 160 degrees apart), cut two grooves, G and G', on this wheel. From the sheet copper, cut a circular blade, "K," ⅞" wide and 160 degrees long. The radius for the outside circle for this is 1⅞"; of the inside, 1". Cut a slit ½" deep, ½" from each end of the blade; bend the copper around and screw to the wheel as shown at G and G' in Figs. "A" and "B". On the upper side of "W" screw the rectangular piece of brass, 1x1⅞"; tap it to receive an 8-32 machine screw. Bend one edge of the blade at G down so the disc will not balk on starting past any switch contacts.

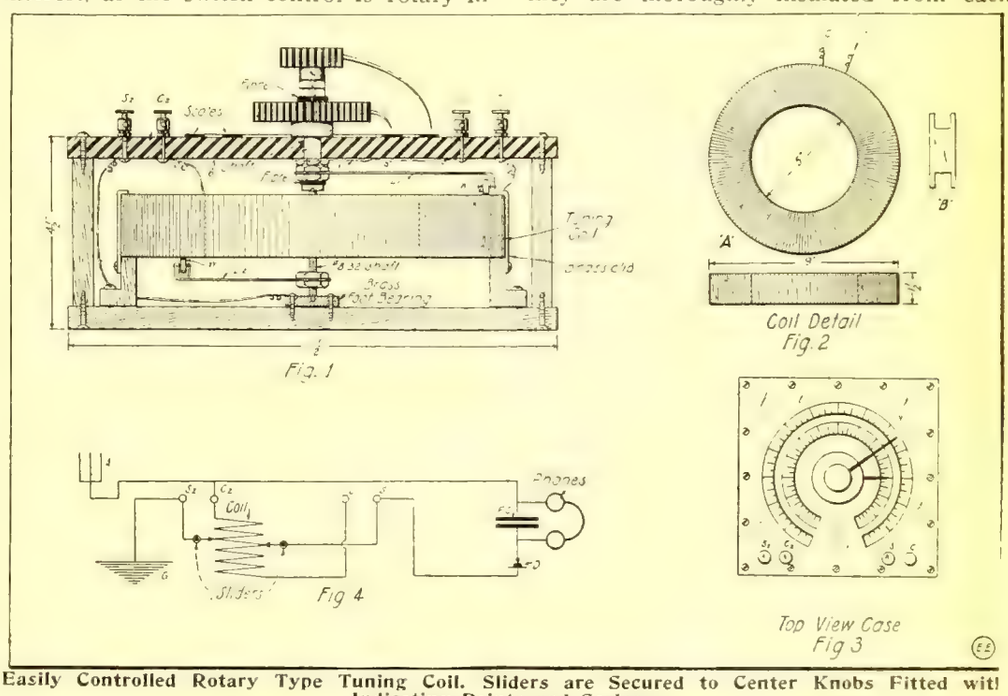
"C" is the turning rod, an 8-32 machine screw furnished with an insulated knob, indicator, and check-nut. Its length depends upon the thickness of the coil base.

It now remains but to assemble the parts. Drill a 3/16" hole through the base of the spark coil to receive screw "D." Push "K" under the springs as shown in Fig. "A." Screw all parts shown in "A" to the under side of the base of the coil, screw "D" down through "R"; screw on and tighten the check-nut. When the knob "D" is turned, six variations in capacity are secured. More can be had by adding additional spring contacts.

Contributed by
MAX EPSTEIN.

A ROTARY SWITCH TUNING COIL.

Those radio operators who believe in tuning coils will find the one described in the accompanying illustration of considerable interest, as the switch control is rotary in



Easily Controlled Rotary Type Tuning Coil. Sliders are Secured to Center Knobs Fitted with Indicating Points and Scales.

character, instead of the more crude "arm's length type," with sliders on bars. This design, here offered, is very efficient, both mechanically and electrically, and to give greater wave length range it may be made larger than here shown. The coil proper is made up on a wooden ring cut out by a fret saw from white pine, or other wood, to the dimensions given in Fig. 2. It should be sandpapered smooth, and the corners rounded. A coat of rather thickish shellac is given it; and, while yet slightly sticky, it is wound with one layer of No. 24 S. C. C. magnet wire.

The winding is done by first placing the wire on a small bobbin or stick, cut as at Fig. 2, B. If all the wire is inconvenient to handle at one time, it may be wound on in several batches, being sure to solder all the joints between various sections where the wire is joined. The coil should be well shellacked or, better, baked out in the oven with Sterling varnish after it is dry. The paths for the rotating arm contact wheels W, W, on arms L_1 and L_2, are sandpapered or scraped on the top and bottom of the coil. This coil winding is good for about 1,500 meters with ordinary aerial. Variable condensers will, of course, boost this wave-length figure.

The other details are perceived from the diagrams; the operating principle of the switches being that the smaller lever (L_2) rod rotates inside of a complete fiber or hard-rubber sleeve, with end washers, placed in the center of the larger moving shaft, which is threaded, as indicated, to receive suitable check nuts. A piece of 1/32 inch or 1/64 inch brass strip "X" is placed on the under side of the top cover, so that contact is made with the larger rotating spindle, S_1. Contact with the smaller spindle attached to lever (L_1) is maintained through the brass foot bearing and wire, as shown.

The whole instrument is mounted in a well-finished, hardwood case, or as the maker may elect. A hard-rubber top makes a fine appearance, and it only need be about ¼ inch thick or less, if backed by a piece of ¼ inch or ⅜ inch wood. Suitable dials are arranged for the needles (see Fig. 3) or indicators to pass over, the scale divisions being in degrees, etc. The scale for the detector circuit slider should be marked "Det." and the ground scale marked accordingly "Ground." Test the assembled shaft with 110 volts and a lamp to see that they are thoroughly insulated from each other. Diagram for standard connection are given at Fig. 4.

Wireless telephony has been successfull tried out on D., L. & W. railroad expres trains.

The D. C. Arc for Wireless Telegraphy and Telephony

(Continued)

SLIDE 10. De Forest's method (see Fig. 9) is almost identical with that of Poulsen, except that he employs alcohol vapor in place of hydrogen.

The Dubilier System.

This is another hydrogen arc system based on the same principles. Dubilier employs an air-cooled arc, and the connections are so arranged that the oscil-

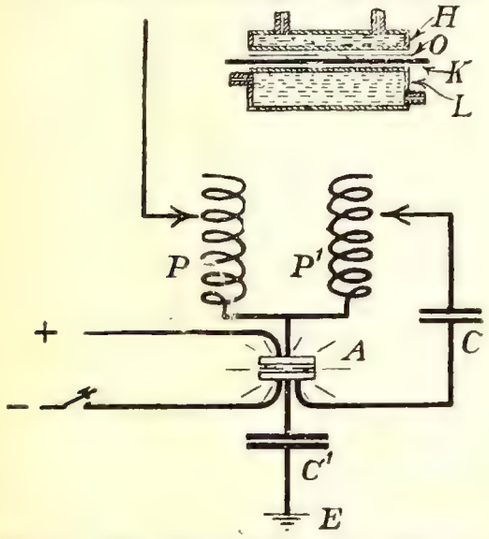


Fig. 12. The Lepel Quenched Arc High Frequency Generator.

lations of both the primary and secondary circuits pass across the arc. The connections are very similar to those used by the Anglo-French Wireless Co.

Slide 11. We now come to a method of generating H. F. currents by means of a number of arcs in series in air (see diagram 10). This method is the outcome of the work of Duddell, Campos and Mosler. It has been thoroly developed by the German Wireless Telegraph Co. in Berlin. When a supply voltage of 220 volts D. C. is employed six arcs in series are required. On 440 volts twelve are necessary. The arcs are struck between water-cooled carbon anodes and carbon cathodes.

Fessenden.

We now come to the work of Fessenden. Those who have read the account of his lecture delivered to the American Institute of Electrical Engineers in 1908, will appreciate the enormous amount of work that he has done in connection with wireless telephony. In 1906 he constructed a H. F. alternator, suitable for wireless telephony. It was he who first used a microphone in the aerial circuit (see Fig. 11). In 1906, by the use of telephone relays of his own construction, he demonstrated the possibility of connecting a land telephone line to a wireless telephone station. I will read the following account from his lecture already referred to:

> "As it was realized that the use of the wireless telephone would be seriously curtailed unless it could be operated in conjunction with wire lines, telephone relays were invented, both for the receiving and transmitting ends, and were found to operate satisfactorily, speech being transmitted over a wire line to the station at Brant Rock, Mass., re-transmitted there wirelessly by a telephone relay, received wirelessly at Plymouth, Mass., and there relayed out again on another wire line."

These tests were witnessed on December 11th, 1906, by a number of scientific men, and reported in the American Telephone Journal. In 1907 Fessenden successfully transmitted speech between his wireless station at Brant Rock and a station in Jamaica, Long Island, a distance of about 200 miles. Fessenden has also invented a balance method of simultaneous transmission and reception.

For the balance method he uses a phantom aerial; this circuit having such capacity, inductance, and resistance as to balance the radiating antenna; also an interference preventer, one of Fessenden's inventions, one side of which is tuned to a wave length of the distant transmitting station. The drawback to this method is that half the energy is lost, and the conversation is only half as loud as it would otherwise be.

At diagram 12 is represented the Lepel system. In place of a hydrogen arc, there is a form of quenched arc. The instrument consists of a sheet of copper and a sheet of delta metal, (both of which are water-cooled), between which is a sheet of thin paper perforated with a small hole at its centre.

This apparatus can be operated by alternating current, in which case it acts as a quenched spark-gap; or it can be operated directly from a constant current supply, provided that the voltage is sufficiently high to form a self-striking arc between the copper and delta metal electrodes. It may be connected to an inductance and capacity in a similar manner to that employed for an ordinary spark-gap, but in practice it is connected as shown, so that both the primary and secondary circuit oscillations pass across it.

The Anglo-French Wireless Co. own and operate this system.

Fig. 13 shows the receiving connections used by the Anglo-French Wireless Co. There is nothing extraordinary about the connections themselves. I am showing this diagram because I think the extremely neat arrangement for the inductance may be of interest. T is the top of a table; a large circular hole is cut at its centre and an inductance is wound in a groove cut in the piece of the table that was removed. This is then pivoted across the circular hole in the table. Inductance 2 is wound in a groove in the table top. Inductance 3 is wound in the form of a flat spiral, and the board on which it is wound is hinged

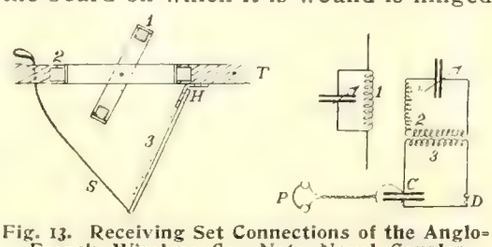


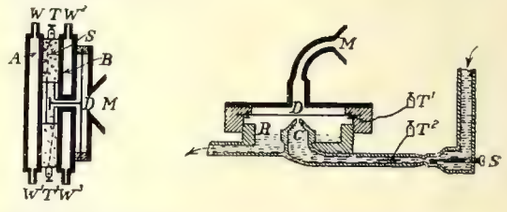
Fig. 13. Receiving Set Connections of the Anglo-French Wireless Co. Note Novel Coupler at Left.

to the underside of the table and can be pulled up and down from above by a strap S to alter the coupling. Inductance 1 is also turnable on its pivot, to alter the coupling.

The Morretti Arc.

There is another form of arc which I should mention, invented by Morretti. It consists of a copper tube supplied with water. An arc is struck between the water and a copper rod; it works on a high voltage direct current and the connections are the same as for a hydrogen arc. The oscillations are produced by a very rapid extinction and restriking of the arc, probably due to an action like that in a Wehnelt interrupter.

In conclusion, I should like to say a word or two as to the most suitable forms of microphones for wireless telephony, and just a word with regard to detectors and receiving apparatus. One of the greatest practical difficulties in wireless telephony has been to find a microphone capable of carrying a large current without becoming "packed" or overheated.



Fessenden's Carbon Grain Wireless Microphone.

Chambers' Liquid Microphone

Fig. 14. Two Types of Wireless Telephone Transmitters.

When dealing with a small amount of power, as I have been this evening, an ordinary "solid back" microphone answers quite well; but this is unsuitable for use with large currents. One way of getting over the difficulty is to connect a number of similar microphones in parallel, with all their mouthpieces connected to one trumpet. This method, however, is not thoroly practical, as the conductivity of each microphone varies from time to time and there is the likelihood of one or more of them overheating.

Fessenden in 1906 invented the first really practical carbon grain wireless microphone, which he claims will carry a current of 15 amps., without packing. The figure on the left-hand side of this slide (Fig. 14) shows the construction of the instrument. The carbon grains are held in a small chamber cut in the centre of a disc of soap-stone "S." Two platinum electrodes at the back and front of the chamber are water-cooled. A small rod passes through a hole in the front water-cooling tank and electrode, connecting the diaphragm D to a small spade or plunger in the centre of the grain chamber, which is only half filled with carbon grains by the way.

Dubilier uses a somewhat similar microphone.

The diagram on the right-hand side of this figure shows a Chambers' liquid microphone. This is another form of microphone. A small jet of acidulated water passes through a nozzle C and plays upon the underside of the diaphragm. When the diaphragm vibrates there is an alteration of resistance of the liquid at this point.

(To be concluded.)

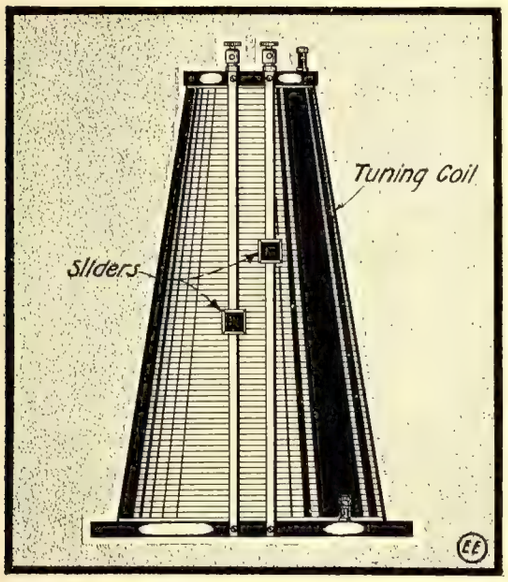
NORRISTOWN RADIO CLUB.

The amateur radio operators of Norristown, Pa., have organized and call themselves the Norristown Radio Club. The officers elected were: Earl Moore, president; Wilbur Heiser, vice-president; Charles Wolfe, secretary; Randolph Roland, treasurer, and Samuel Place, consulting engineer. The club would like to hear from such associations. Norristown Radio Club, Main street and Franklin avenue, Norristown, Pa.

RANDOLPH ROLAND,
Treasurer.

IMPROVED CONICAL TUNING COIL.

A decided improvement, which is not very well known, by the way, in the design and construction of tuning coils for use in wireless receiving sets is shown in the illustration. The improvement, in general, is based on the fact that with a tapered or conical coil it is possible to greatly increase



Conical Form of Tuning Coil, Equally Efficient on Long and Short Waves.

the flux density in the region of the lesser diameter turns on the coil when only a small inductance is used in picking up a certain signal coming in on a short wave length. When a longer wave length is being received, any part of the coil can, of course, be used. The idea, of course, to be followed is always to include as much as possible of the smaller end of the coil. It will be evident at once that when short wave lengths are being received much greater efficiency in the instrument will be the result when the turns of wire are small. This is the reason why extra large loose couplers and tuning coils are very inefficient on small wave lengths where only a few turns of wire can be used.

A common form of conical tuning coil is, as shown, provided with two sliders. The wood form on which to wind the wire may be turned in a lathe or can be made up at any cabinet maker's for a few cents.

It may be suggested that the conical form on which to wind the wire be made about 2½ inches diameter at the small end and 6 inches diameter at the larger end. It can be 11 to 12 inches long and wound with one layer of No. 24 enameled magnet wire. The wire, of course, is scraped or sandpapered free of insulation in the two paths where the sliders are to make contact. It is connected as usual in the radio receiving circuit.

TO FORM RADIO CLUB.

In December last members of the Y. M. C. A. branch at Asbury Park, N. J., interested in wireless telegraphy assembled for the purpose of organizing a wireless club. Jewell VanDyke and Harold Warren supervised the club. It is the purpose of Mr. Warren to teach the wireless code to the members, and there is no doubt but that within a short time the members will be able to receive messages nicely. During the past few weeks experiments carried on by Warren and VanDyke have in a large measure been successful, and messages are constantly being received. Mr. VanDyke is connected with the VanDyke Electric Company.

Novel Wireless Telephone Microphone

An ingenious wireless telephone microphone designed to carry several amperes, and which does not heat unduly or "pack," as ordinary carbon grain microphones tend to, is described by Mr. Scheidt-Boon in T. S. F. Our cuts of the instrument show clearly its novel means of handling heavy radiophone currents without over-heating.

Referring to the diagram we perceive at Fig. 1 a cross section view of the "continuously renewed" carbon grain microphone. Into the hopper (5) is placed a quantity of carbon grains which, of course, drop down and against the valve at 9. This valve (9) is mounted on a pivoted beam or lever (3), so that the two magnet coils (1, 1) can act on the iron armature secured to the end of the lever. The cup (10) catches the carbon grains as they fall through the opening (9).

The valve (9) may be arranged in different ways, as at Figs. 2 and 3, Fig. 2 being an angular valve and Fig. 3 a conical seat.

Now the action of the microphone will be readily understood from Fig. 4. Here an ordinary microphone (16) creates varying electric currents through the primary circuit (17, 18, 19, 20) of an induction coil. The secondary circuit (21, 22, 1) thus causes the magnets to exercise a varying magnetic pull on the lever (3), which is mounted on a circular metal diaphragm, and which vibrations correspond with the voice undulations occurring at (16). Hence the vibratory movement of the lever and valve (9) will cause a changing quantity of carbon grains (with consequent varying resistance) to pass through and between the two electrodes 23 and 24 (Fig. 4), which will thus vary and control the aerial oscillating current. The source of high frequency aerial current is not shown, but it may be a radio-frequency alternator or a Poulsen arc generator.

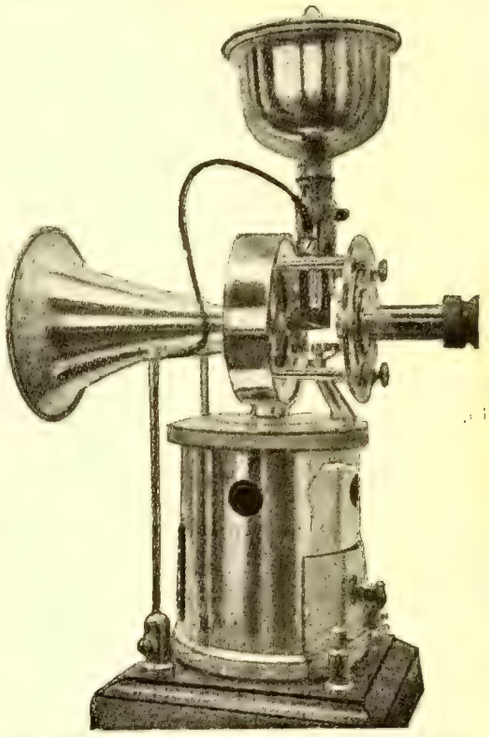
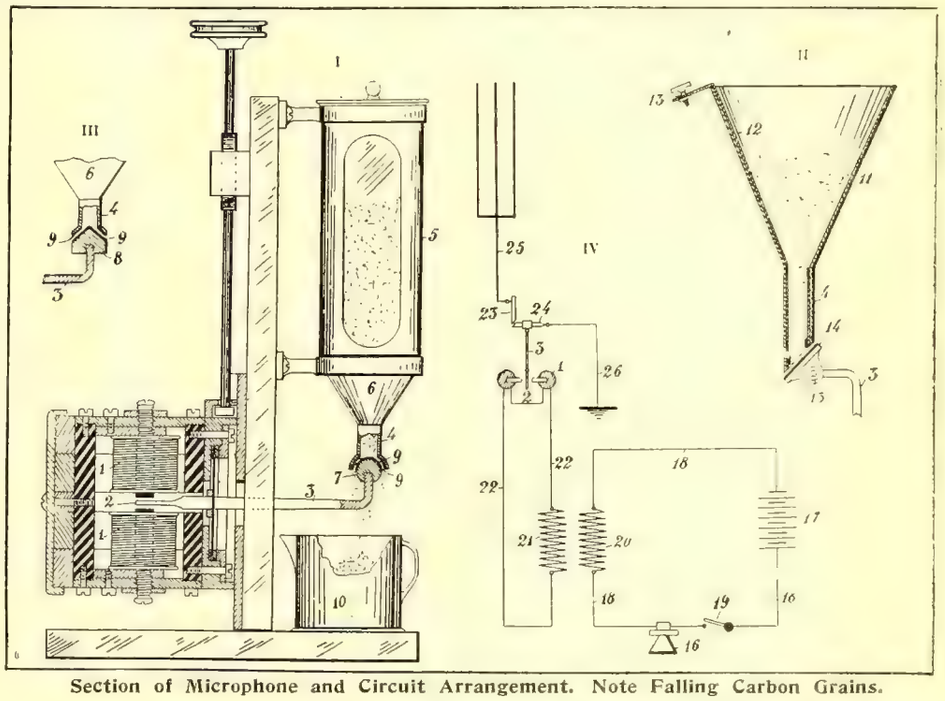


Fig. 5. The Carbon Grain Stream Microphone.



Section of Microphone and Circuit Arrangement. Note Falling Carbon Grains.

Fig. 5 is a photographic illustration of the device just described. The large horn to the left leads to the microphone, while the cup-shaped piece at the top contains the carbon grains.

YOUNG MARCONI RADIO CLUB.

The "Young Marconi Radio Club" met at the home of Albert St. Cyr, Jr., 319 Harrison St., Marquette, Mich., and an election of officers took place. The officers are as follows:

President and Secretary, Albert St. Cyr, Jr.; Vice-president, Herman Bittner; Treasurer, Edward Lundstrom; Chief Operator, Walter Frie; Assist. Operator, Will. Gasper.

We would like to correspond with other clubs.

ALBERT ST. CYR, Jr.,

COLLEGE RADIO CLUB NEWS.

At the last meeting of the Club, an election of officers for the ensuing year resulted as follows: Wm. C. Nolan, president; Earl S. Shader, vice-president; Phil W. Pelts, secretary, and O. C. Pavia, treasurer. Jack Forsythe is stenographer. Several new members were admitted and a plan for the year's work outlined.

PHILIP W. PELTS, Secretary, 612 Adams Avenue, Memphis, Tenn.

A round magnet coil contains the least resistance with a given core section.

HOW-TO-MAKE-IT DEPARTMENT

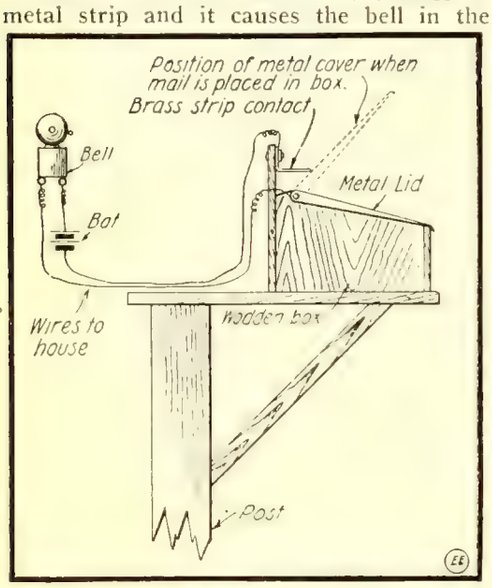
This department will award the following monthly prices: FIRST PRIZE $3.00; SECOND PRIZE $2.00; THIRD PRIZE, $1.00.
The idea of this department is to accomplish new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best ideas submitted a prize of $3.00 will be given; for the second best idea a $2.00 prize, and for the third best a prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings.

FIRST PRIZE $3.00.

RURAL MAIL BOX ALARM.

I herewith give a suggestion which I am sure will meet the eye and taste of everyone living in a rural district where the mail is placed in a wooden box fastened on a post by the roadside. The purpose of my suggestion is to have an announcing bell at the house when the mail is placed in the box by the mail carrier and thus make a long wait unnecessary. The only article necessary is an electric bell which may be bought at any store for 25 cents. A roll of insulated bell wire must also be used. To furnish the current two or three dry cells are to be procured. Two cells will be sufficient for any distance up to 200 feet. Cut one thin brass strip, as shown in illustration, and also procure a metal lid to form a cover for the box. Both brass strip and metal cover are each put in connection with two copper wires strung to the house. The wires are simply tacked (by staples) on small posts driven in the ground, and the rest of the wiring, as shown in diagram, is very simple. The idea of this arrangement is as follows:

As soon as the mailman lifts the lid and places the mail in the box the metal lid comes in connection with the brass or metal strip and it causes the bell in the



First Prize: Rural Mail Box Electric Alarm Bell.

house to ring as a signal that the "mail has arrived." Submitted by

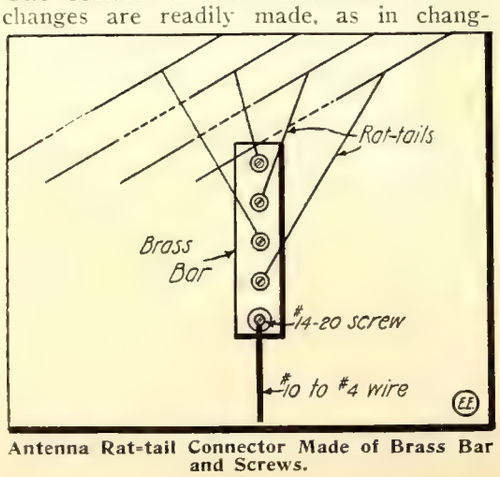
WILLIAM WARNECKE, JR.

SIMPLE ANTENNA CONNECTOR.

A very simple and efficient antenna rat-tail connector is illustrated below. This is made up from a piece of copper or brass bar about ½ by ¼ by 2½ inches. Four or more No. 8-32 machine screws are tapped into the bar, and these are furnished with washers under the heads, enabling the No. 14 wire rat-tails from the aerial flat-top to be clamped securely.

At the base, where the main lead-in wire or cable goes down to the instruments or lightning grounding switch, a heavier machine screw is fitted on the bar. This may be about No. 14-20 size machine screw.

If the lead-in wire is larger than No. 10 B. & S. conductor it is best to screw a lug under this screw and to sweat the large wire into the lug with solder. The rat-tails are usually tapered down to the connector for a distance of 10 to 20 feet. One feature of such connectors is that changes are readily made, as in changing from looped to straight-away system.



Antenna Rat-tail Connector Made of Brass Bar and Screws.

SECOND PRIZE $2.00.

UNIVERSAL CRYSTAL DETECTOR.

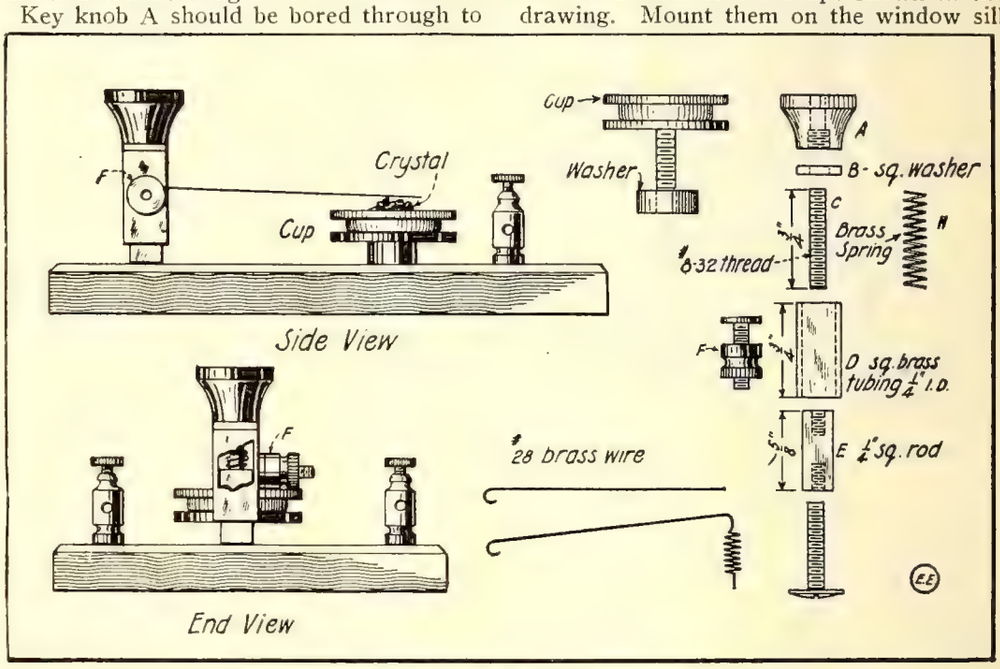
The following notes, in addition to the drawings, will explain the construction of this crystal detector. All materials not on hand can be bought at a nominal cost.

Key knob A should be bored through to the brass bushing to permit the passage of the threaded piece C. A square brass washer, B, is soldered on top of D and the binding post F to the side of D. This binding post can easily be made by filing down the head of a binding post taken from the zinc side of a dry battery. The square rod E is drilled and tapped at both ends to admit an 8-32 thread.

"Electro" sliding cup and slide make a very satisfactory device for holding the crystal, as the contact wire slants down to it, the pressure being regulated both by the knob and by sliding the cup.

This detector is adaptable for use with all crystals employing a wire contact for their operation.

Contributed by W. H. HALE.



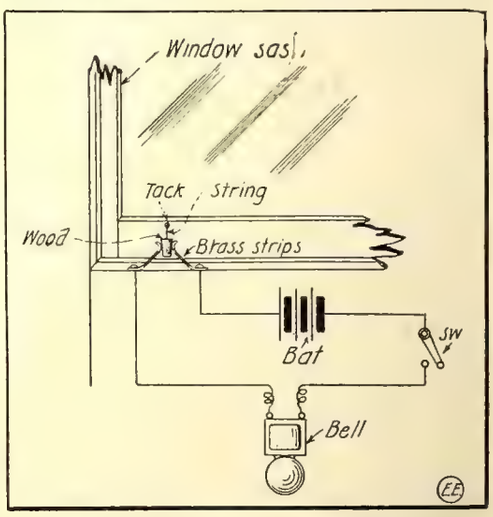
Second Prize: Clever Radio Detector for Using Galena and Other Minerals.

THIRD PRIZE $1.00.

NOVEL BURGLAR ALARM.

Herewith is a plan for a simple electric burglar alarm.

First, get two pieces of springy brass and bend them to the shape shown in the drawing. Mount them on the window sill so that the top part of each are touching together. Put a small strip of wood between them where they touch. Drive a small tack in the upper end of the strip of wood. On this tie a string, also attached to the window sash.



Third Prize: Electric Burglar Alarm for Windows.

When the window is raised it pulls the strip of wood from between the brass strips. This closes the circuit and rings the bell until it is turned off by a switch.

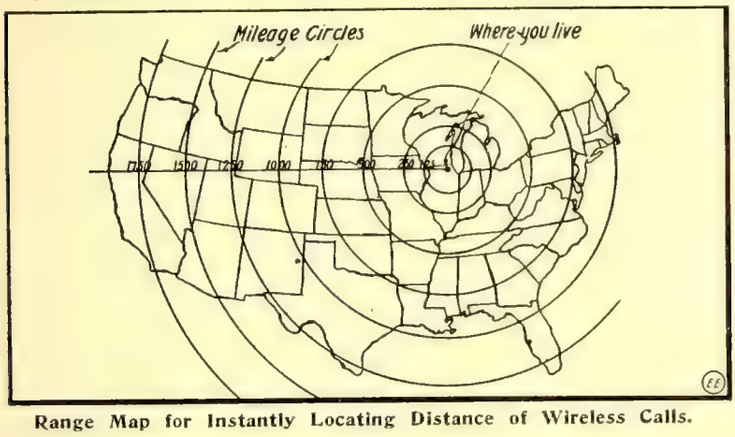
Contributed by HARRY HARVEY.

RAILROAD WIRELESS.

L. B. Foley, superintendent of telegraph, telephone and wireless, Lackwanna Railroad, New York, accompanied by Dr. Lee de Forest, left for San Francisco recently, to look into the merits of the Poulsen continuous wave system.

WIRELESS RANGE MAP.

Here is a diagram of a map that will help wireless operators a great deal. As I am a wireless operator, I find this map very useful in determining the distance between the sending station and receiving. I thought you might wish to publish it in your valuable paper, *The Electrical Experimenter*:



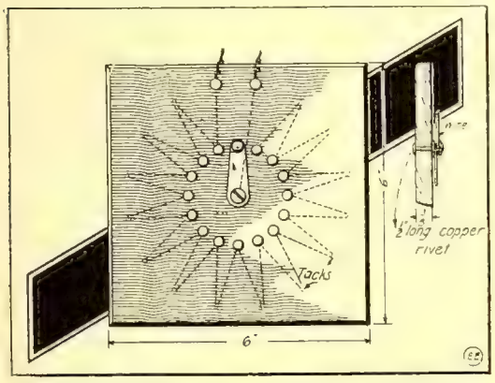
Range Map for Instantly Locating Distance of Wireless Calls.

First, I made a map of the United States; then I made circles, with *Malta*, Ill., as the center, because I live here, but the person who makes one must make his home the center, in order to find the distance in miles in all directions without any difficulty and at a glance tell the distance of the other station which is sending. I find it is very useful.

Contributed by WILBUR PHELPS.

HOME-MADE RHEOSTAT.

This is a description of a home-made rheostat: Make up a piece of wood 6x6 inches and ⅜ inch thick. Find its center and circumscribe a circle with a radius of 1⅛ inches. Lay off 18 points on this circle and on every point drill a little hole through the board, except the two points on the upper side of the board. After this take 16 ½-inch copper rivets and put them in the holes. Turn the board upside



Rheostat Composed of Few Feet of Resistance Wire and Copper Rivet Switch Points.

down and lay on every rivet a copper washer. Now get some high-resistance wire, such as iron, German silver, etc., attach on the first rivet and lay out at a sharp angle to the outside on the board and wind it in nearly two turns around the second rivet, and so on till the last rivet is finished. Now get a switch lever and attach to the center of the board. On the top of the board attach two binding posts: from one binding post connect a wire to the switch lever beneath the board; from the other binding post run a wire to the first copper rivet. Now lay on every copper rivet a washer and hammer the rivets down and the wire will fit tightly between the two washers. At last the whole board should be painted with a nice-looking color of paint. This little rheostat can be made at a very low price.

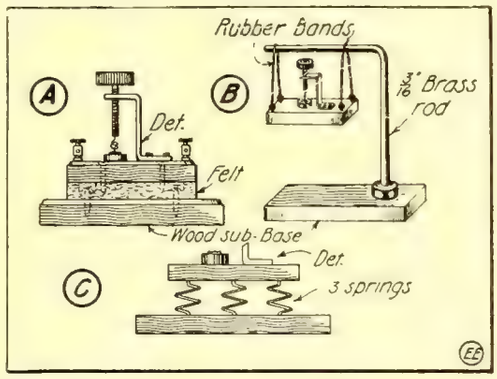
Contributed by JOHN BLANKE.

NON-VIBRATION MOUNTING FOR DETECTORS.

One of the principal troubles encountered when using wireless detectors of the ordinary type, such as those with delicate "cat-whisker" wires on them, etc., is that they are subject to vibration from tables, or even the building in which they are located. To overcome these troubles several schemes are shown in the sketch herewith.

At A the detector is so mounted on a piece of thick felt that no solid connection results between the base of the detector and the wood or other sub-base, which may be the table top.

A simple scheme to apply, and very efficient also, in the elimination of vibration transmission is that outlined at B, where the detector base or piece of wood fastened under its base has say, four small screw-eyes fastened at the corners of the same, with some rubber



Three Methods of Mounting Detectors Free from Vibration.

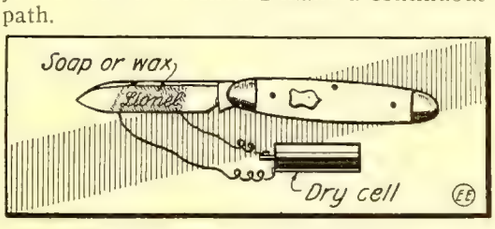
bands fastened over the brass arm as shown, so that the detector swings on the rubber bands.

Another simple way of overcoming vibration in the detector is to mount the base of same on three or four springs, as outlined at C in sketch.

ELECTRO COPPER COATED ETCHING.

Take five cents' worth of blue vitrol stones. Dissolve in one part of water and add two tablespoonfuls of salt, which makes the etching fluid.

Now, for the object to be etched: Take a knife blade, for instance. Take a piece of yellow laundry soap and rub on the knife blade until a thin coating is on the knife; then, with a sharp-pointed pencil or pin, scratch your initials or any other object on same. It should make a continuous path.



Copper Etching on Steel Blade.

Now pour the liquid just prepared on the blade until entire initial, or other object, is covered.

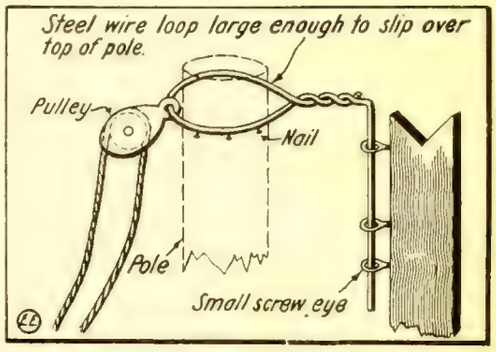
Take a common, dry battery and lay both wires in the liquid and leave for about two minutes.

Then rub soap off and you will have the initials, or other object, copper-coated and also etched into the knife blade.

Contributed by LEO G. DRISCOLL.

AN AERIAL POLE WRINKLE.

While it does not often occur, I should think somebody besides myself has had or perhaps will have trouble with the rope breaking or jumping the pulley on an aerial mast.



Simple Way to Arrange Aerial Pulley for Removal of Rope.

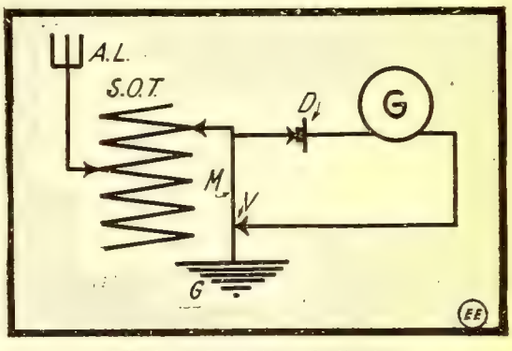
Recently I put a 35-foot pole in my yard, and the rope jumped the pulley, which kept it from being moved either up or down. I broke the rope in the attempt and thought it necessary to take the pole down, although it was firmly guyed. I at last devised the little scheme shown in the drawing, and with three clothes props and a little wire replaced the pulley with a new one threaded with new rope. Submitted by

RANDOLPH ROLAND.

THE GALVANOMETER AS A RADIATION INDICATOR FOR RADIO TRANSMITTERS.

By Wm. H. Dettman.

Nearly all sensitive galvanometers are only capable of responding to direct currents or to alternating currents of very low frequency, and therefore cannot be used in the regular way for measuring high frequency currents such as are utilized in wireless telegraphy.



Efficient Radiation Indicator.

Fig. 1 shows a method whereby a direct current galvanometer can be made to serve as a radiation indicator in place of a hot-wire ammeter commonly used with radio transmitters. S.O.T. is the secondary of the oscillation transformer; AL is the antenna lead, while M is the ground lead. The galvanometer (G) is connected in series with a detector of the rectifying type, such as silicon or galena. The galvanometer and detector are shunted across a few inches of the ground lead. The galvanometer circuit should not be too close to the transmitter. The detector must be adjusted to sensitiveness in the same way as when used with a receiving set; while making these adjustments the hand should not come in contact with any metallic parts of the detector, as this will interfere with the reading.

The above resonance indicator is superior to the hot wire meter in that it does not increase the resistance of the aerial circuit as the hot-wire meter does.

A NOVEL THREE-CUP DETECTOR.

Procure a piece of square brass rod ¼" square and 5" long and a detector arm including the thumbscrew.

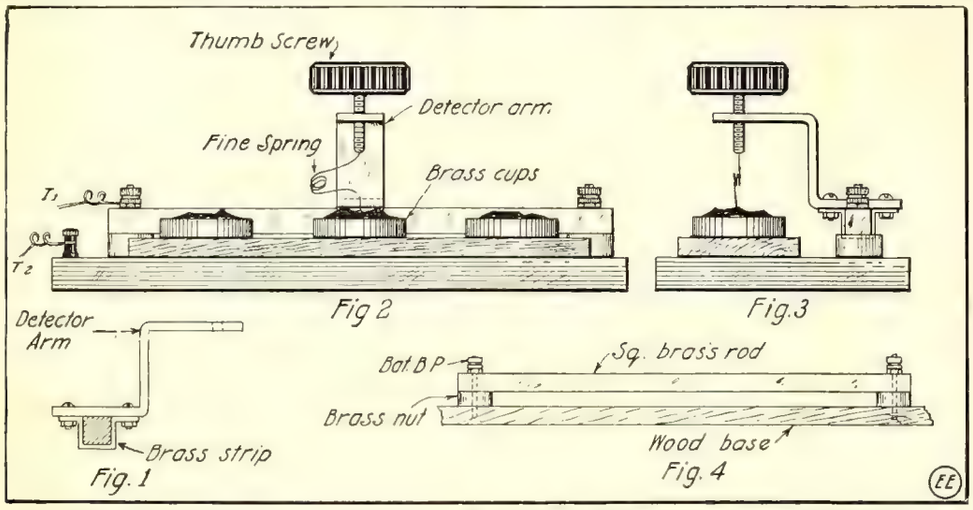
A detector arm may be taken from an old detector which is not in use or may be purchased. The kind used on the "Electro" galena detector is very good.

Next, get a brass strip 1¼x¼x1/16" and bend it around the rod and fasten soldered to the brass plates on the under side; thus making a very neat instrument.

The diagrams are self-explanatory and carry all necessary dimensions. Everything required may be procured from any electrical supply house.

If desired, each plate may have its corresponding detector name, etc, etched on them by coating the plates with wax, scratching the name in same with a sharp instrument and filling the grooves in the wax with acid. Afterward the etched grooves can be filled in with black enamel and the plate surfaces polished and lacquered.

Submitted by
JAMES L. GREEN.



Any Mineral at Once Available by Simply Moving the Vertical Arm Along the Slider Box.

to the detector arm as shown in Fig. 1.

The brass strip must not be so tight as to hinder the arm from sliding along the rod. A hole should be bored in each end of the rod and two holes in the base the same distance apart as those in the rod. The rod should be elevated from the base by placing a nut between the base and rod. Then the battery binding posts are inserted in the holes and tightened as shown in Fig. 4.

The base, which is 6x3x⅜", should be of fibre, but hardwood may be substituted.

Get three brass cups from the carbons of old batteries or they may be purchased from any supply house.

Get a wood or fibre block 4x1x¼" and bore a hole ½" from each end and one in the middle, just large enough so the cups may be pushed snugly into the holes. Screw the wooden block to the base under the thumbscrew and parallel with the brass rod, as shown in Fig. 2.

Then get three different minerals, for instance, silicon, galena and molybdenite, and place one in each cup. They may be fastened in same by packing tinfoil around them or by Hugonium Alloy. Connect all the cups together and to a binding post T_2.

Then connect the brass rod to another binding post T_1, and it is complete.

If you wish to use galena, you may slide the arm along until it is along side the cup in which the galena lies, etc.

More cups may be used, but the detector must be made longer according to the number of cups used. This detector saves the trouble of having more than one complete detector and a switch for them.

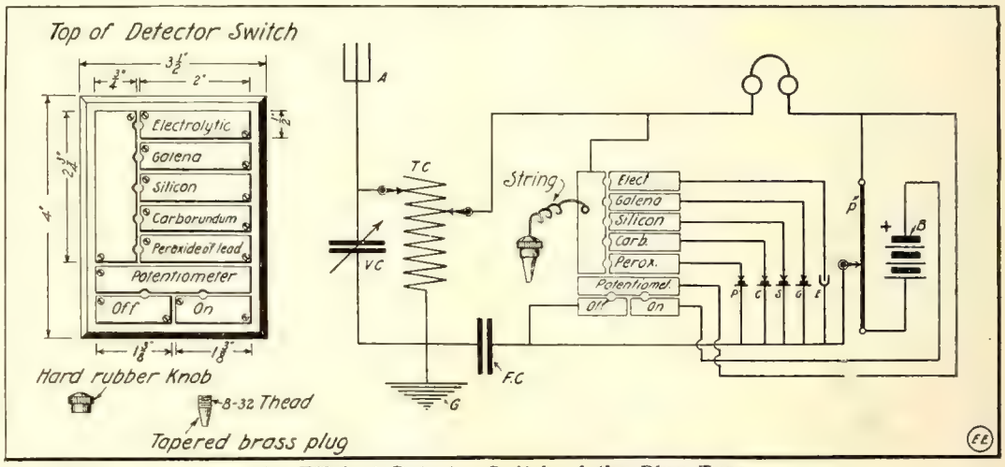
Submitted by
SHERMAN APPLEGATE.

A PLUG TYPE DETECTOR SWITCH.

The accompanying plan and description are of a very practical detector switch which the writer recently made, and is sending along for E. E. readers.

The switch is made of sheet brass and connections are made by means of small brass plugs.

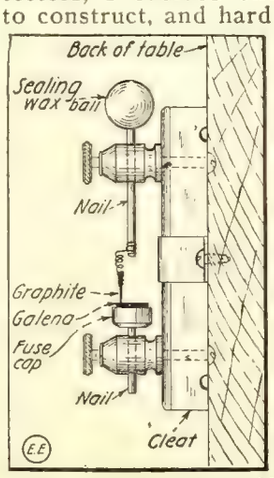
The brass should be about No. 20, and the pieces mounted on a base, leaving 1/16" between them. The wires are



An Efficient Detector Switch of the Plug Type.

A SIMPLE WIRELESS DETECTOR.

After some experimenting with detectors, I evolved one, cheap and easy to construct, and hard to beat for sensitiveness and ease of adjustment, factors necessary in long distance receiving.



I have given a sketch showing its construction. Merely a two-wire cleat, two ordinary binding posts, two 8 penny nails, a brass cap from a fuse, some sealing wax and a short piece of lead from a hard lead-pencil; also a few inches of spring or copper wire about No. 30.

These are assembled according to the drawing. The two posts are mounted in the holes in the ends of the cleat, then cut one nail off 1" from the head, solder brass cap to it, cut other nail off about 2" from head, dip the head in melted sealing wax and turn it slowly; this will form a handle. Make connections to back of posts, then clamp cleat against back of table with a brass strip ½" wide, slip shorter nail with cap into lower post, slip other nail in upper post, then fasten the lead to the upper nail by means of some fine wire. Place a piece of galena in the cup and pack it tight with small wads of tinfoil and adjust.

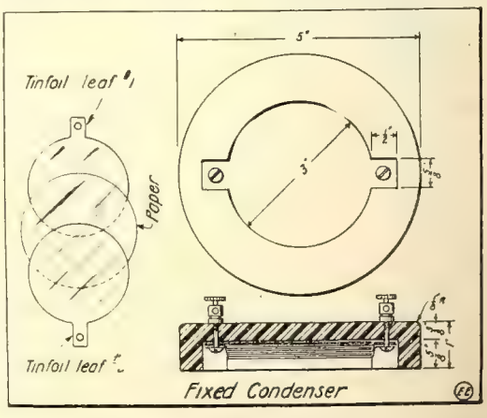
It is important that the lead have a very sharp point touching the galena.

Contributed by
THOS. W. BENSON.

A RADIO BLOCKING CONDENSER.

Here is a description of an effective fixed or blocking receiving condenser. The wood used in the construction of this condenser is preferably one that takes a high polish, such as mahogany or oak. A circular piece of wood 5 inches in diameter is turned up with a hole in the center 3 inches in diameter, having a depth of ¾-inch. Slots on the side of this are made to allow space for the lugs of tinfoil and the binding posts.

Twenty sheets of tinfoil are cut out with a diameter of 2½ inches, having lugs ⅝-inch wide and ½-inch long. Twenty-one circular pieces of paraffin paper are made 2¾ inches in diameter. The tinfoil and paper are placed alternately upon each other, so that every other lug lies on the same side. They are placed in the base,



Blocking Condenser Made from Tinfoil and Paper in Circular Wood Base.

binding posts are inserted and the remaining space is filled with paraffin.

The dimensions are given in the diagram.

This condenser presents a neat and pleasing appearance and is a valuable addition to any receiving set.

Submitted by PERCY M. ROOPE.

U. S. PATENT OFFICE

ELECTRICAL-MAGAZINE-REVIEW

IMPROVED SELENIUM CELLS.

In an article in the *Physical Review* Mr. D. S. Elliott describes a new construction of selenium cells, due to Pfund. It is particularly adapted for low-temperature work. Amorphous selenium was first cast into discs about 1.5 cm. in diameter and 1.5 mm. thick. They were sensitized in the usual way, being maintained at a temperature of 200 deg. C. for six hours and then cooled rapidly to room temperature. The

Fig. 1.

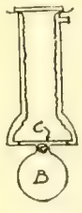


Fig. 2.

discs were then ground smooth on crocus cloth, after which silver tape electrodes were fastened on with celluloid. A film of gold was next deposited by cathode sputtering, and finally the gold was removed along a narrow line like a grid as shown in Fig. 1. No deleterious action due to mercury vapor could be detected. The cell was finally inclosed in a glass tube similar in design to that shown in Fig. 2. The smaller bulb was filled with calcium chloride and the constriction leading to the upper chamber was loosely plugged with cotton. The cell was fastened with sealing wax in this upper chamber, the end of which was closed by a glass plate. The vessel was also provided with a side tube for exhausting by means of an aspirator, a phosphorous pentoxide tube being inserted between cell and aspirator during the process.

IRON CONDUCTORS INSTEAD OF COPPER.

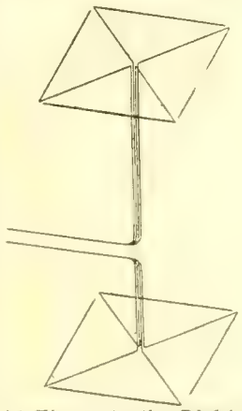
The present European war brings to the front the somewhat unfamiliar idea of using iron and steel wires for overhead conductors and even for other purposes. The effect of the war in cutting off the importation of copper from Germany has been considerable—just how great it is quite impossible to tell, but great enough to raise the question here discussed. Tests made both for direct current and alternating current have shown that in using relatively small wires with low-current densities the iron conductor can be made surprisingly effective, even for alternating currents, when the matter of cost is taken into account. So effective is it, indeed, that at a possible ratio between the cost of iron and that of copper; conductors of the former material may pay well. It is only when the conductors are of the larger diameters and carrying considerable current that the serious effects of the change in material become conspicuous. While at home the cost ratio of iron as compared with copper is unfavorable, yet, if a recent quotation reported from Germany of $600 a ton be correct, the balance may well be turned in the other direction.—*Electrical World.*

TIME-FACTOR IN SELENIUM RESISTANCE.

The Time-Factor in Selenium Resistance is covered in the "Physical Review" for Sept., 1914, in an article by G. E. Grantham. It is well known that the electrical resistance of selenium does not reach an equilibrium value instantaneously after exposure to light, and the rate of change of resistance on exposure is much greater than the recovery rate. The problem suggested the use of a rotating disk from which sectors are cut to allow the light to fall upon the cell, the cell being in one arm of a Wheatstone bridge with some device for connecting a galvanometer in the bridge circuit at a known time interval after exposure. The author describes experiments made by this method. The relation between time and resistance for the preliminary experiment is shown in curves. During the first hour the rate of change of resistance increases with the speed. During the remainder of the time the cell approaches the equilibrium resistance. This equilibrium resistance is the resistance of the cell at the time that the decrease on exposure is just equal to the increase in the dark. A discussion of the results is given on the assumption that selenium consists of three components.

INTERNATIONAL COMMISSION ON RADIOTELEGRAPHY.

Below we give part of a discussion by William Duddell of the proposed work to be undertaken by the International Commission on Wireless Telegraphy. At the sending station it is necessary to measure the antenna current, which requires ammeters suitable for high frequencies and strong currents up to 150 amperes at least. Hot-wire instruments must be used. The author proposed the arrangement shown in Fig. 1. It consists of two copper tubes, on each of which a series of notches is made. A thin wire passes in zigzag fashion from one notch to another, as shown in the illustration, so as to form a kind of squirrel cage. The two tubular electrodes are given a rotary movement with regard to one another, causing the wires to fall on the surface of a hyperboloid of revolution. Two wires are stretched along the axis of the hyperboloid and joined together in such a way that the weld (giving a thermocouple) is at the central part of the narrowing or contraction. These wires are taken to a millivoltmeter. With an instrument of this kind an e.m.f. of 5 millivolts is obtained when a current of 150 amperes passes. The nature of the antenna to be used at the control station requires very careful consideration, in order that changes, for instance, in the earth may not affect the accuracy of the results. Probably Lodge's type of antenna, as shown in Fig. 2, is best. On the other hand, it might be well to see whether a receiver with closed circuit, such as has been described by F. Braun, might not be better. Among its other advantages is the fact that the properties of the circuit could be defined very exactly and kept constant. At the different receiving stations it is necessary to determine the strength of the signals that are received, partly with a view to comparing results from day to day and partly to compare the results which are obtained at the different stations on the surface of the earth.



At Fig. 1, to the Right, New Form of High Capacity Hot Wire Meter. At Fig. 2, to the Left, Lodge Balanced Antenna Proposed for Quantitative Test.

Electricity is used to locate the bullets in the European war victims.

ANENT THE TUNGSTEN LAMP.

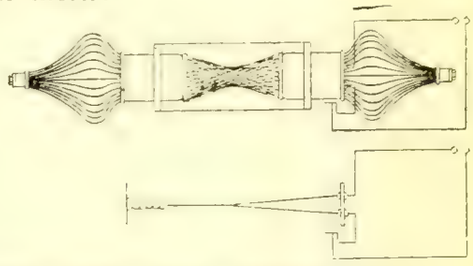
Four years ago three carbon lamps were sold for every Edison mazda lamp; to-day 12 Edison mazda lamps are sold for every carbon lamp. If all the filaments used in the Edison mazda lamps manufactured in 1913 were made into one length they would stretch for 50,000,000 feet, or nearly half way around the earth, says the *Edison Business Builder.*

WEAR ON OVERHEAD TROLLEY WIRES.

An illustration of the wear which takes place on overhead trolley wires occurred on the Blackpool Corporation Tramway system (English) recently, when a length of nine miles of wire was renewed. A one-yard length of the old wire, which has been in use 12 years, was found to have lost 55 per cent. of its original weight, says *The Electrician,* London.

SOME "ENGLISH" SHORT CIRCUITS.

Contributions to this section (in the shape of definitions of well-known electrical objects) are invited from the witty members of the industry, says *The Electrician,* London. "Hot plates" will be awarded from time to time for the best efforts, and we give below some of the first efforts:



D. C. Turbo-Generator: A machine with a past, valueless as a present, and without a future (try A.C. Turbo-generator).

Gas Engine: A mechanical monstrosity, of which it has been rightly said that the connecting rod is often in doubt as to the direction it was intended to take.

Centrifugal Pump: The practical embodiment of the science of rotating squirts.

Wattless Currents: The fruit of the Watt-le (see also What'll ye have).

Professor: One who professes something, sometimes to teach, more often to know. May also act as consulting engineer.

Dry Cell: A cell which is of no use unless it is kept moist (vide Scotchman).

Commission: Money paid not willingly, but grudgingly and of necessity.

[Ed. Note.—*What have our readers to say? Suppose you think up a few good electrical definitions on this order. If good enough we will publish them.*]

THE COOPER HEWITT MERCURY OSCILLATOR.

Dr. Peter Cooper Hewitt has announced completion of the preliminary work on a new development of his well-known mercury-vapor lamps and rectifiers. The new inventions involve improvement on the vacuum-tube rectifier for feeble high-frequency currents, such as occur at the receiving station of a radio-telegraph or radio-telephone system and the development of an oscillator or converter which efficiently transforms direct current or low or high voltage into sustained

(*Continued on page 27.*)

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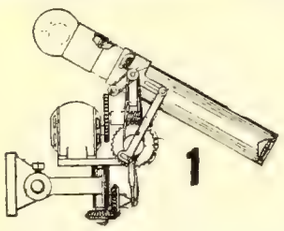
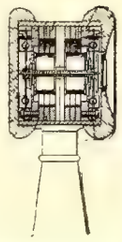
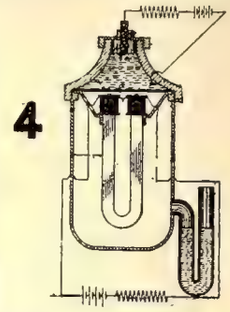
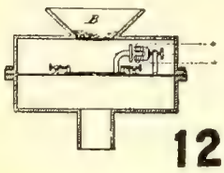
LATEST PATENTS









ADVERTISING LAMP (Fig. 1)—A motor continuously moves the lamp tube up and down; the tube projecting an image on the sidewalk, etc.

TELEPHONE RECEIVER (Fig. 2)—Novel receiver in which opposite balancing effect acts on spring-supported armature. Two magnet coils are used.

ELECTRIC AUTO SIGNAL (Fig 3)—A rear signal for autos, comprising arrow heads illuminated when auto is to turn corners. Center lamp lights license number.

ELECTRIC RELAY (Fig. 4)—A relay comprising a diaphragm for receiving vibrations, and a fluid medium for transmitting said vibrations from said diaphragm to secondary circuit.

BATTERY CONNECTOR (Fig. 5)—Improved connector cable and lugs with split springs, preventing nuts from vibrating loose.

STORAGE BATTERY PLATE (Fig. 6)—Scheme to have all vertical ribs in plate point toward a hypothetical center of electrolysis distribution, O.

A. C. VIBRATING RECTIFIER (Fig. 7)—Has a vibrating armature, 21, corresponding in period to the A. C. frequency. Hence will pass + and miss — waves, and deliver D. C. to storage battery, 7, etc.

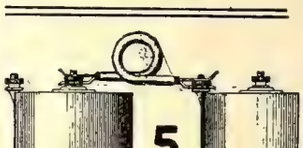
MAIL BOX ALARM (Fig. 8)—Alarm with bell, switch and battery. Closed cover tell-tale, rings bell and moves indicator to read "Mail."

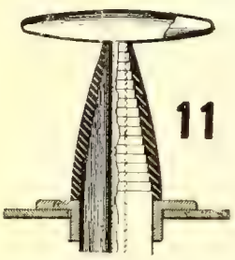
CURIOUS ELECTRIC MOTOR (Fig. 9)—Three suction type electromagnets act on crank pin disc alternately to rotate shaft. Includes switching gear.

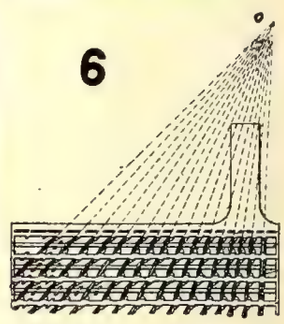
ELECTRIC HORN (Fig. 10)—Simple horn, actuated by electric buzzer joined by resilient spring between armature and horn diaphragm.

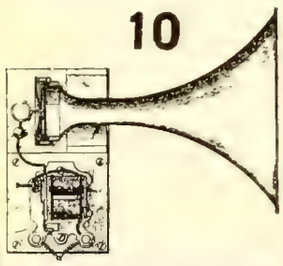
NOVEL ELECTRIC INSULATOR (Fig. 11)—Terminal insulator with condenser leaves wrapped around it, shaped to conform to electrostatic field about it.

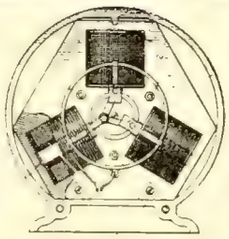
ELECTRO-PNEUMATIC SOUND BOX (Fig. 12)—A blast of air is fed into the lower pipe. Electromagnet actuates a gate valve. Escaping air vibrations pass out horn, B, giving rise to sound. Amplifier principle.

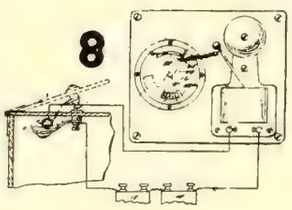


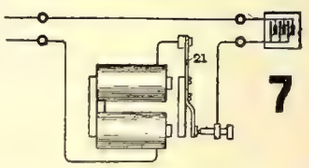






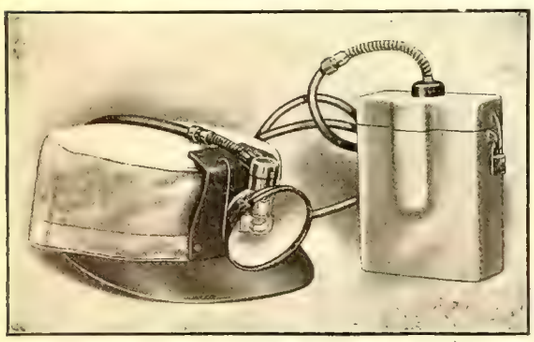






ELECTRIC HEADLIGHT FOR MINERS.

The miner of this era has a much more efficient and agreeable source of light available than his brother of other days. Then it was the oil lamp, with its attendant odors and unsteady, flickering beam. The modern electric miner's headlight is a great boon, indeed. A typical form of standard



Electric Headlamp for the Miner. Storage Battery Supplies Current.

equipment for these requirements is here illustrated.

The battery used is a small storage cell of several plates, placed in a leak-proof, vulcanite container or tank. Two wires lead up from the battery, placed at the miner's waist in the rear, to the headlight arranged for fastening to his cap, as shown. Suitable switch is provided to open and close the lamp circuit. This outfit is highly developed in its details so no undue trouble will be experienced from acid leaking out of the battery, etc. The terminals of the battery are so made as to be acid- or corrosion-proof. Hundreds of the batteries are charged at one time in a battery house. Usually the cells are joined in series while charging. One charge will last a day.

Do You

realize that there are over 75 original articles and over 100 original illustrations in this magazine.

THE NEXT ISSUE WILL BE ENLARGED AGAIN

and many new and original features will be found in it.

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HAVE YOU AN IDEA?

Are you using a new device or an improved modification of such, in your wireless or electrical laboratory? If so, why not write it up and send to us with a photo or sketch? Drawings invariably have to be made over by our draughtsmen, and just so you express your ideas concretely and as briefly as possible, we are always glad to publish them, when the article possesses merit. Look over this issue carefully, re-read the articles twice, and you will soon pick up the knack of writing articles, and, moreover, we pay you well for your efforts. Why not get busy to-day and get in the swim? Be a live, wide-awake Electrical Experimenter! Boost your paper and boost yourself. It's very easy!

Make all sketches on separate sheets of paper, and write only on one side of your text sheets. Address the Editor.

HOW TO BIND "ELECTRICAL EXPERIMENTER" COPIES.

A simple method to bind copies of the *Electrical Experimenter* together is as follows: On the side where the leaves of the magazine are bound together punch two holes, one at the top and one at the bottom. Do this to all of the magazines and then put ordinary paper fasteners through these holes and bend the ends over.

Contributed by EARL HUGHES.

AMONG THE AMATEURS

Our Amateur Radio Station Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of stations unaccompanied by that of the owner. Dark photos preferred to light toned ones. We pay each month $3.00 prize for the best photo. Make your description brief. Address the Editor.

AMATEUR RADIO STATION CONTEST.

Monthly Prize, $3.00.

This month's prize winner.

WIRELESS STATION OF HARRY WEBER.

Sending condenser: Open rack type, consisting of 14 plates 16x18 inches connected series-parallel, with eight knife switches to vary capacity. Mounted in hardwood rack. Have completed oil-immersed condenser since photo was taken.

Rotary spark gap: Twelve discharging points on aluminum disc, driven by 1/10 H. P. Robbins & Meyer's motor, with Cutler-Hammer rheostat.

Oscillation transformer is composed of two spirals of heavy brass ribbon. Have Brandes hot-wire ammeter reading 0 — 5 amperes. I use anchor-gap and aerial switch that controls rotary gap; also have heavy wireless key. I get a reading of 4 amperes on hot-wire meter.

The aerial of my station is composed of four strands of 7-22 phosphor bronze cable, 70 feet high.

Transmitting set consists of 1 kw. commercial transformer, closed core, with six variations of power. Secondary voltage, 16,000.

Prize-winning Radio Station of Harry Weber.

The receiving set comprises: Loose coupler with primary and secondary tubes of Bakelite with six taps on primary and 10 on secondary. One variable can be thrown in series or shut in primary circuit; other variable in shunt with secondary. Cabinet is finished in black and is hand-rubbed and highly polished. Use storage battery to light audion filaments. I am getting good results with this set, and hear many amateurs within a radius of 500 miles. I can read a ¼-kw. set 300 miles distant and a ½-kw. set almost 800 miles away. Stations within 300 miles copy my signals strong, and I am heard at distances of 600 miles. I made all the instruments except the transformer. My call is 8 AM. Would like to arrange tests with any amateurs that hear me. Yours truly,

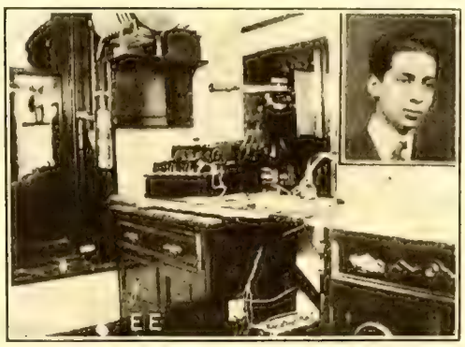
Canal Dover, O. HARRY WEBER.

BARRUTTE RADIO STATION.

The accompanying photograph shows part of my radio station which I desire to enter in your monthly prize contest.

The receiving set consists of a Marconi inductively tuned cabinet set. The tune can be changed from direct to inductive by a rocker switch. The detector is of the crystal type, and can be adjusted very quickly, and it is aided by a set of batteries and a potentiometer. The capacity used consists of a variable and fixed condenser. A loading coil and phones complete the set.

The set will respond to wave lengths of 15,000 meters. The sending apparatus consists of a 6-inch spark coil operated on 24 volts. The primary circuit is com-



Mr. Barrutte's Radio Outfit in Brooklyn, N. Y.

pleted by a navy type key, which is seen in front of the relay. The condensing unit consists of Murdock moulded condensers and a flanged air-cooled gap. The tuning is accomplished by an oscillation transformer. The antenna switches are shown on the switchboard. I have been picked up at New Canaan, Conn., by M. B. Porter, who has a large radio station there.

I can just about copy "NAM." My official call is 2PC.

L. BARRUTTE.

Brooklyn, N. Y.

STUART RADIO SET.

Below is a photo of my wireless station and electrical laboratory, the aerial and also a small one of myself.

My aerial, 108 feet long by 60 feet high, is composed of four strands of seven-strand copper wire spaced on 10-foot spreaders. It is grounded when not in use by a 100-amp. switch.

The transmitter consists of a ½-kw. 13,200-volt closed core transformer, a condenser of 60 photographic plates, connected series parallel. The rotary gap

Stuart Wireless Station and Aerial.

has 12 aluminum plugs and runs about 4,000 revolutions per minute. The oscillation transformer is of my own design and construction, and the wires are Nos. 6 and 8 aluminum, respectively.

The receiving set is of the cabinet type, and is complete by itself. It contains a 3,000-meter loose coupler wound with Nos. 24 and 32 wire, a loading coil, two fixed condensers, one rotary variable condenser, a Galena detector of the catwhisker type and a buzzer test. I also have a buzzer in the attic controlled by a push button within easy reach of my foot. My phones are 3,000-ohm Murdock type. I can hear NAA at noon with my phones several inches from my head. I have a license and my call letters are 1BG.

The large Tesla coil at the top of the picture was constructed similarly to one described in this paper a few months ago.

I have been a reader of the *Electrical Experimenter* for the past two years, and am pleased to see it growing in size and wish it came weekly instead of monthly.

H. CORCELL STUART.

St. Johnsbury, Vt.

RADIO STATION OF C. L. ROBINSON.

I give you herewith photo and description of my wireless station. Most of the apparatus are of Commercial make or made by myself. The outfit consists of the following instruments: One-inch Bulldog spark coil, one-pint Leyden jar, quenched and open spark gaps, key, aerial switch and five dry cells. Receiving outfit: Loose coupler of my own make, silicon detector, variable condenser made of two tin cans

C. L. Robinson and His Wireless Laboratory.

for use across L. C. secondary, one 1,000-ohm receiver, receiver shunt condenser and necessary switches. All the instruments are of my make except the spark coil, receiver and Leyden jar.

My aerial consists of four No. 12 galvanized iron wires 100 feet long, 20 feet high at one end and 25 at the other, with two lead-in wires from center, making a "T" aerial. The spreaders are 10 feet long. I have a brother living about one-quarter of a mile away and a neighbor who lives about one mile from one, both of whom have stations which I can hear fine. I also have a friend about four miles south of me who is putting up a station. I live in the Ozark Mountains in a valley, with hills on each side about 300 feet high, which accounts for me not being able to receive any great distance. I have tried grounding contact side of detector, which brings in signals considerably louder and some you can't hear at all without the ground. C. L. ROBINSON.

Laquey, Mo.

Submarines use electricity to propel them under water.

QUESTION BOX

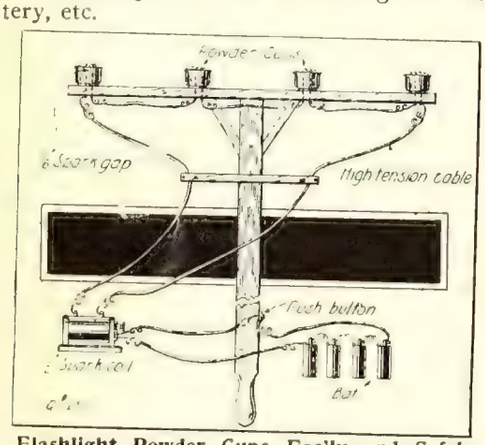
This department is for the sole benefit of the electrical experimenter. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail.

SPARK COILS FOR FLASHLIGHT IGNITION.

(257). D. A. Biggard, Frankford, Philadelphia, Pa., wishes to know about a spark coil for use in igniting photo flash-light powder?

A. 1. We would suggest a ¼" spark coil for your work, in igniting flash powder. You may use some No. 16 or 18, twisted lamp cord for connecting the battery, etc.



Flashlight Powder Cups Easily and Safely Ignited by Means of Spark Coil.

We believe you would find a ½" coil best if you intend to use several spark gaps in series, as your sketch indicates.

Diagram is given herewith showing how to connect up one of these coils for the 4 powder cups.

PLUNGER ELECTRO-MAGNET PULL FORMULA.

(258.) W. Le R. B., New York, has some solenoid or plunger electromagnets to build and wants to know how the strength of same can be computed?

A. 1. We give you herewith formula for calculating the pull in pounds for any length action of solenoid magnet on direct current; and you can thus readily compute the power of same.

The pull in lbs. of a D-C. solenoid is:—

$$P = A\,I\,N\left[\frac{I\,N}{l_1 c^2} + \frac{C}{l}\right], \text{ in lbs.}$$

In which: A is area core section in sq. in.; I is current in amperes; N the number of turns of wire; *la* the length of air-gap in inches; *l* the length of the coil inches, while *c* and C are constants. For soft iron cores at ordinary flux density, c=2660 and for *l* greater than 10 dia. coil; C=0.0096. For full details on this subject with design curves from actual magnets built, see Underhill's "Solenoids and Electromagnetic Windings," which we can supply at $2.25 postpaid.

WATCH DEMAGNETIZERS.

(259.) Berries & Co.,——; please give us full details on how to make a "Watch Demagnetizer" for direct current, 110 volts.

A. 1. Refer to the September, 1913, issue of this journal; worth five cents. Other numbers of *The Electrical Experimenter* can be supplied as follows: 1913 numbers, excepting May, June, July, or October; 1914 numbers, excepting January issue; price five cents straight, the copy, prepaid.

1-4 inch COIL CONDENSER.

(260.) Alan C. Rockwood, Iowa City, Iowa, states that his small ¼" spark coil sparks excessively at the vibrator and wants to know the remedy.

A. 1. This is most probably due to a breakdown of the primary condenser. A condenser suitable for this purpose may be composed of about 18 sheets of waxed paper, covered on both sides or interleaved with tin-foil sheets about 3 inches square; leaving ⅜ inch margin of paper around the tin-foil. Connect every other foil leaf to either side of the vibrator, alternately; i. e., 9 sheets to each side.

In regard to the small rheostat, would say that the voltage drop of same may be figured from the resistance which is 10 ohms and the current capacity which is 2 amperes at full load; or the volts drop equals Res. × Current, or 10×2=20 volts drop.

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LIGHT ACTION ON SELENIUM.

(261.) A. J. Hain, Lakewood, Ohio, inquires as to the action of light on selenium, partly covered over with an opaque shutter or screen, etc.

A. 1. Relative to the action of Selenium Crystals, etc., would advise that wherever the Selenium is covered over with some light-proof material, the Selenium at that point will become of very high resistance. Of course, a slight effect will probably be made on the Selenium so covered by reflection from the uncovered surface of same, as you intimate.

As a matter of fact, it has generally been found that the resistance of Selenium Cells varies pretty well in proportion to the amount of light thrown on same.

Selenium in stick form, chemically pure, may be purchased on the market. However, its resistance is infinitely high in the pure state. It has to be fused, crystallized and carefully annealed before its action is the same as in standard cells.

You will find considerable information on Selenium Cells and their construction in the August, 1914, *Electrical Experimenter.*

RADIO CIRCUIT PROTECTION.

(262.) Dayton D——, Limon, Colo., mentions the use of small fuses for protecting wireless sets from static aerial currents:

A. 1. Fuses are hardly ever used in protecting radio receiving apparatus from static or lightning discharges, and the common method of giving such protection is to connect an anchor spark gap about 1/100 of an inch long, across the aerial and ground wires where they join the receiving set. This system is used in the United States Navy, and also on most commercial installations.

There is no law stating definitely that you may not use a stationary spark gap, and these can be employed for short range wireless transmitters, where they do not send over the border line or interfere with the interchange of government or commercial radio messages over such State boundary line.

A. C. QUESTIONS.

(263.) A. L. Franklin, Chickasha, Okla., asks several questions on A.C. motors, transformers, etc.:

A. 1. Twice the size of wire now used on the coils on your 60-cycle A.C. motor, should be employed for the new winding and consequently one-half the number of turns should be placed on same, for 120 cycles frequency. You may figure the circular mils area of any wire from the Brown & Sharp wire table given in most textbooks and catalogs.

It is probably best to connect two receivers with widely different resistances on multiple, but two high resistance receivers should be connected in series and the same holds true for a pair of similar type, low resistance receivers.

The wave length of loose couplers, is explained in detail in the September, 1914, issue of *The Electrical Experimenter.*

Any transformer will show a small consumption of current on watt-hour meter in the primary circuit; even though the secondary is open circuited. This small current consumed by any transformer as mentioned, is known as the magnetizing current.

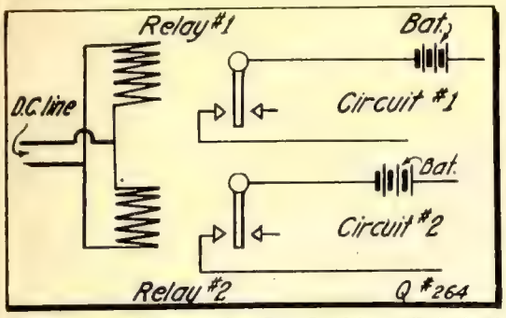
POLARIZED RELAY PROBLEM.

(264) Walter J. P——, Grand Rapids, Mich., asks us about using 2 single polarized relays, etc., to signal when direct current is passed through the circuit in a positive or negative direction and vice versa. Relays to remain open when no current traverses control circuit.

A. 1. Relative to the use of polarized relays, special circuits, etc., we may say, first, that you can employ a couple of the plain polarized relays hooked on to the circuit in parallel as shown in the diagram.

If you wish to have one relay of the dif-

ferentially wound type act to close a local circuit, when positive or negative current is passed through the coils of same, you will have to arrange the armature with balancing springs on either side; so that nor-



With no Current in D. C. Line, Polarized Relays 1 and 2 Remain Open. Positive or Negative Current Through D. C. Line Closes Respective Relay.

mally or with no current in the magnet coil circuits the armature will rest midway between the two platinum contact screws of the relay. About six to seven milli-amperes are required to operate these relays.

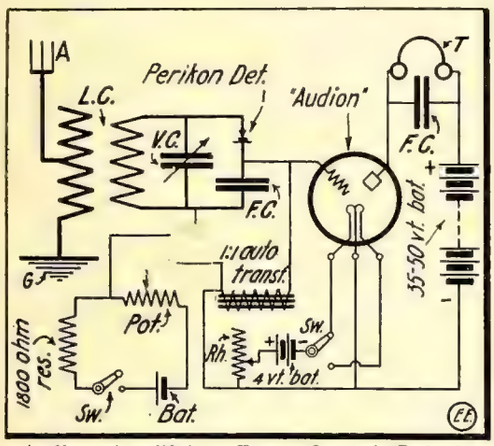
AMPLIFIER HOOK-UP.

(265) J. W. Halligan, New York City, asks us:

Q. 1. Is the diagram I show correct for using an Audion to amplify the wireless signals as received on a crystal detector, such as the Perikon?

A. 1. The diagram you show is not correct. We do not believe it would work at all. We give you below proper diagram showing how to arrange a single Audion bulb to amplify from a Perikon Detector, and it is claimed that this arrangement will yield as high as 20 amplification factor.

The diagram is quite plain and needs no lengthy explanation. The auto-transformer of 1-1 ratio shown should have about 9,000 ohms resistance and is very well composed



Audion Amplifying From Crystal Detector.

of three or four spark coil secondaries. These should be placed end to end with a common soft iron wire core passed through their center. A Perikon detector is suggested as best for the purpose, and the potentiometer shown is for adjusting the battery current applied to same.

D. C. DYNAMOS.

(266) Frank Moore, Kemp, Tex., wants advice on small D. C. dynamo building.

A. 1. On the matter of small dynamos and their windings, etc., we refer you to the excellent 25c. book by Marshall, which we supply, entitled, "Small Dynamos and Motors and How to Build Them."

We may say that in general, with a given size of armature, it is rarely possible that you can gain any great amount in output from the machine by increasing the field strength to any extent; providing, of course, the field is of sufficient strength in the first place, all things considered. This is due to the basic fact that the output in amperes of

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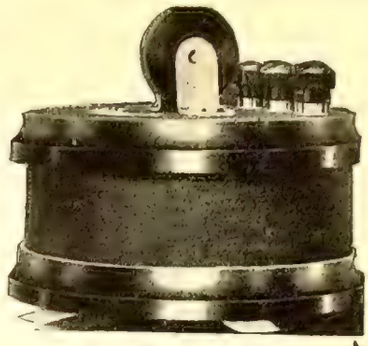

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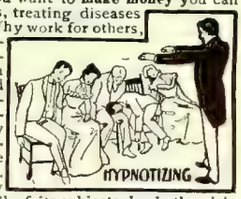

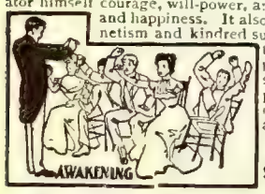

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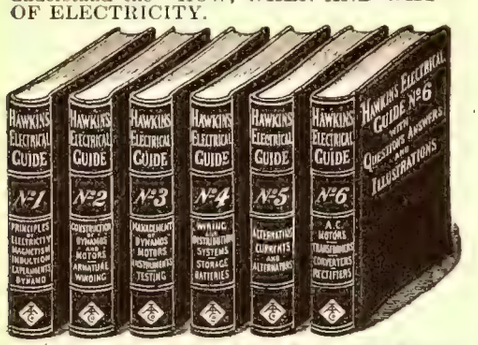

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the armature, and conjointly of the dynamos, depend upon the size of the armature conductor or wire. This is invariably figured for D. C. machines at 600 circular mils per ampere of armature current. You can thus readily figure the capacity of any armature from a common wire table as given in any text-book, catalogues, etc.

With an armature having two field poles and two brushes on the commutator, there is of course provided two divided paths through the armature for the current, and each half of the armature would thus carry one-half the total current; that is to say, that if the armature was to develop or handle a total current of 100 amperes, then each half of the armature winding would carry 50 amperes, or the armature winding would be designed to have a cross-sectional area of 50 times 600 circular mils.

TRANSCONTINENTAL TELEPHONY.

(267) A. L. Franklin, Chickasha, Okla., wishes to know the strength of current used in telephoning across the continent.

A. 1. We may say that 48 volts from a storage battery is the principal current used in sending speech from New York to San Francisco over the Bell system. However, this current works through an Audion type amplifier, and the secondary or wing circuit of the amplifier has about 100 to 110 volts battery current in same.

A. 2. In regard to the human body having a resistance of, say, 5,000 ohms or more, measured from hand to hand, and the effect of applying 50,000 volts through this circuit from a small induction coil, will say that as the coil could only deliver a small fraction of an ampere, you could not, of course, cause any greater current than a minute fraction of an ampere to flow. Shocks from spark coils are always very unpleasant, and in the case of some persons the discharge from a fairly large spark coil may indeed prove fatal.

RANGE OF RADIO STATIONS.

(268) Orval Shryock, Box No. 1, Brighton, Ia., asks about the range of radio stations.

A. 1. We do not quite understand your query as to how far a certain radio receiving station can operate over, but may say that it must have an aerial large enough and instruments of sufficient sensitivity to pick up so many micro-watts out of the ether or from the transmitted etheric wave.

To make this matter clearer, we will suppose that you have an ordinary amateur station located on the Atlantic coast of the United States. Now, suppose that you try to pick up the wireless signals from the Eiffel Tower. Undoubtedly, you will not be able to accomplish this unless you have a particularly large aerial, say 1,500 feet long, with the very best instruments, including some form of amplifier. However, we may remark that several commercial and private radio stations of the very highest character in design, etc., located around New York City, pick up the Eiffel Tower repeatedly, and also hear the German stations working regularly every day; whereas the small amateur stations cannot do this, as their instruments are not of sufficiently high sensitivity and efficiency, and also their aerials are entirely too small to pick up sufficient energy. About 30 to 40 micro-amperes in the receiving station aerial circuit will give good signals on a first grade set.

AERIAL ANTENNA CURRENT.

(269) Wm. Rogers, Ohio, Ill.

A. 1. The transmitting range of a wireless station depends in general upon the amount of watts expended in the antenna. In fact, it is given by the following for-

A Fortune to the Inventor

who reads and *heeds* it, is the possible worth of the book we send for 6 cents postage. Write us at once.
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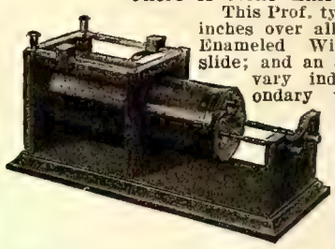

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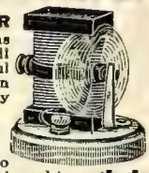

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mula, wherein I^2 is the current in the antenna as read on a hot wire ammeter; R O is the actual or ohmic resistance of the antenna circuit, and R D is the radiation resistance of the antenna circuit. This latter term, R D, is usually about four times the ohmic resistance. The watts radiated $= I^2 \times (R O + R D)$. As you will perceive, this expression really takes into consideration the watts in the circuit. About 10 watts to the mile may be figured on for small and medium size plain sparks gap type transmitters, with closed core transformers.

LONG DISTANCE RADIO RECEIVING.

(270) F. L. Peoples, Jacksonville, Fla., writes us about a receiving set for transatlantic service.

A. 1. With reference to reciving transatlantic messages, will say that undoubtedly for this work you will have to use a pretty large aerial, one having, say, a length of 1,000 to 1,500 feet and composed of a couple of strands of phosphor bronze cables.

This stretch of wires should be elevated 150 to 200 feet, and preferably more, above the ground, and the wires should be spaced about 20 feet apart and well insulated; also, in such an event you will have to use the very best phones possible, and undoubtedly some form of amplifier, unless your radio receiving set is particularly efficient.

LAMP BULB EXPERIMENT.

(271) Russell Baley, Hillsboro, Wis., states that he tried lighting an incandescent lamp bulb from the secondary terminal of a spark coil, and wants to know why the filament in the bulb was attracted to the glass.

A. 1. The effect you describe with regard to holding an ordinary 16 C. P. electric light bulb in your hand near a spark coil is a common one and familiar to all electrical experimenters. Most probably the reason why the filament in same is drawn toward the glass wall is due to the fact that the human body gathers an electric charge, and this is spread over the outside of the glass on the bulb. This charge, of course, tends to attract the charged filament inside the bulb by electro-static action.

A. C. TRANSFORMERS FOR TELEGRAPHY.

(272) D. A. Hoffman, Akron, O., inquires about using small A. C. step-down transformers for a short telegraph line instead of batteries.

A. 1. You may use step-down low-voltage transformers for the telegraph line you are interested in. You can use a ground return if desired, and if an accidental short circuit exists on the line very long it is liable, of course, to burn out the transformer windings. You should in this case place a very small fuse wire or link in the secondary circuit to protect against such short circuits. Regular fuse block and fuses should, of course, be placed in the primary transformer circuits of 110 volts, etc., as usual.

HOW TO TELL THE POSITIVE WIRE.

The electrolysis of water is a familiar example of the decomposing effect of the *direct* electric current. By the use of such a current water can be resolved into its component elements, hydrogen and oxygen. In order to do this the terminals of a direct electric current are inserted into a dish or glass containing the water. The positive terminal in known as the anode, and the negative as the cathode. When the current is turned on, it passes through the water from the positive to the negative terminal (from the anode to the cathode), and electrolyzes or decomposes the water. The most gas bubbles are given off at the negative electrode.

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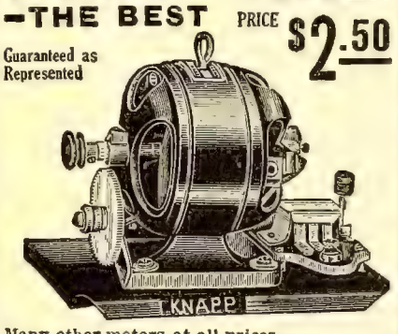

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A "WIRELESS" MENU.

The members of the Institute of Radio Engineers recently gave a dinner at New York City in honor of Mr. R. H. Marriott, United States radio inspector, who had his headquarters in New York City, but who was transferred to Seattle, Wash. The following "wireless" menu was served, and Dr. Alfred N. Goldsmith acted as toastmaster in the absence of Dr. John Stone, president of the Institute:

(Note: We are enjoined from serving courses at a frequency exceeding 250 per second.)
Automatic Starter to Order.
Rat-tail of Non-adjustable Bare Bluepoints for Bivalve Detectors.
Gumbo Electrolyte in Insulating Container of fixed capacity.
Portable Submarine Equipment in Dielectric.
Brush Dischargers. Oval Insulators.
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High Powered Cheese.
Radiation from Tree Antennae.
Ungrounded Coffee.
(Note: Saturation point should not be exceeded. Avoid examining tikker.)

COOPER HEWITT MERCURY OSCILLATOR.

(Continued from page 21.)

alternating current of any frequency, says *Electrical World*. Altho the rectifier is now said to be in such form that it may be used as a radio receiver of sensitiveness considerably greater than that of the most delicate electrolytic detectors, since the incoming energy is not only rectified but amplified, it is the oscillator which Dr. Hewitt believes to be of the greater commercial importance, both in radio signaling and in the transmission of power. At the present time the technical and physical details of the apparatus cannot be disclosed.

During the experimental study of various peculiar phenomena which occasionally accompany the operation of the mercury-arc rectifier, Dr. Hewitt encountered nearly a year ago an entirely novel set of conditions. Close investigation of these developed the fact that under certain circumstances the relations between current, voltage and resistance in the vapor conductor were of a kind absolutely outside the limits of his previous experience. Research into these curious effects resulted in the new oscillator, which, Dr. Hewitt states, is dependent upon electrical principles quite different from any hitherto used.

Not only is the physical basis of the invention a departure from earlier work, but the results already achieved have not previously been obtained through any other instruments. Even in its laboratory form, the oscillator has been found capable of producing, from direct current, sustained alternating currents of any frequency up to 100,000 or more cycles per second. The efficiency of conversion is excellent, and the low internal losses of the apparatus indicate that commercial use in numerous ways will be entirely feasible. In contrast to oscillators which have heretofore been suggested, the device is inherently capable of handling large amounts of power.

A characteristic of the device is that the frequency of oscillation may be

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varied instantaneously over a wide range of values, which feature should increase the importance of the oscillator in its application to radio transmission. Similarly, the output in power may be altered easily and quickly, and through this property Dr. Hewitt anticipates that the apparatus will find extended use as a generator for radio-telephony. The instrument appears to be extremely rugged and to a large extent, self-protective when subjected to potentials much above the normal values used in operating.

Several distinct modes of operation are possible for the oscillator, and at the present time exhaustive researches, including oscillographic studies, are being made into the complicated electrical actions in the circuits of the apparatus. The correlation of these data now being obtained with the results of earlier investigations into gas and vapor conduction phenomena, should assist in the rapid growth of the new oscillator into a commercial machine. Dr. Hewitt has expressed the belief that after a reasonable period of development, such as was required to bring the mercury rectifier to its present forms, the oscillator should find extended practical use in many fields besides that of radio signaling.

AMATEUR WIRELESS PLANTS CLOSED BY GOVERNMENT.

Reports from a number of readers located in the western part of the United States, including the Philippines, indicate that close restrictions are being enforced by Government radio authorities in charge, regarding the operation of amateur wireless stations. As the majority of these stations, or at least those possessing sufficient power to cause any trouble, are all registered under the radio law now in effect, it does not seem fair to shut down every amateur radio station indiscriminately.

The radio amateur is entitled to as much attention as anyone else, and besides he is sworn to an oath of secrecy if he possesses a Government radio license.

We give below a letter from Mr. Walter Maynes, of San Francisco, which explains what we are driving at in part:

"In the Sixth Radio District, which embraces California, Utah, Nevada, Arizona and Hawaii, the radio amateurs have been refused permission to either send or receive ever since the war in Europe began. Rear Admiral Pond, of the Twelfth United States Naval Inspection Department, placed the ban on the wireless amateurs, much to their regret. The Sunset Radio Association, San Francisco, of which Walter Maynes, a licensed operator, is president, has taken the matter up, and is circulating petitions throughout the entire Sixth district for signatures of amateur operators, the intention being to present these petitions to Admiral Pond and induce him to lift the ban.

"The amateurs pledge themselves to a strict observance of the nation's neutrality, and hope to be placed on their honor, in the matter of sending and receiving. All operators in this district are eagerly availing themselves of the opportunity to sign the petitions and thus boost the good work. These petitions may be secured by addressing either Walter Maynes, president, 207 Hugo street, San Francisco; Carroll Reed, secretary, 1683 Seventh avenue, San Francisco, or Howard Lee, 1580 Grove street, San Francisco."

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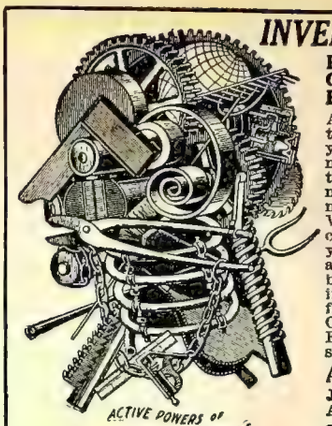

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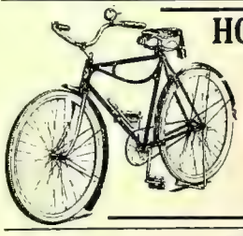

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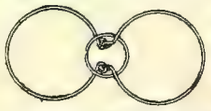

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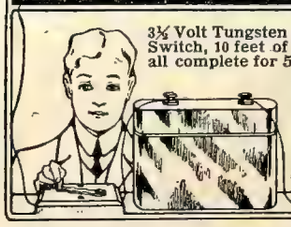

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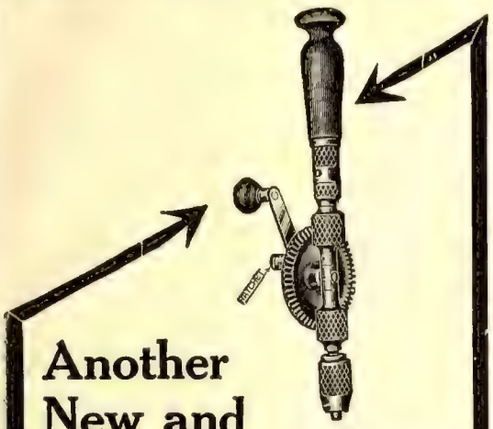

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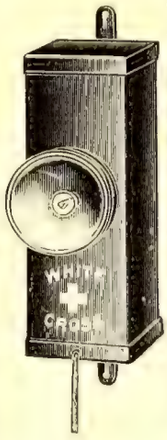

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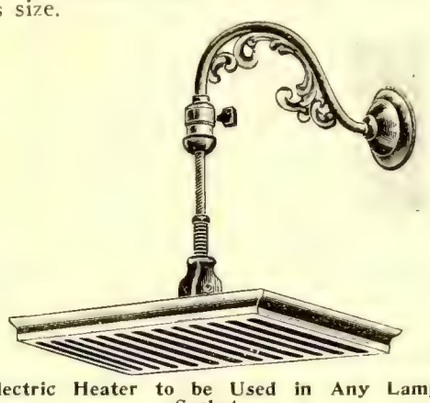

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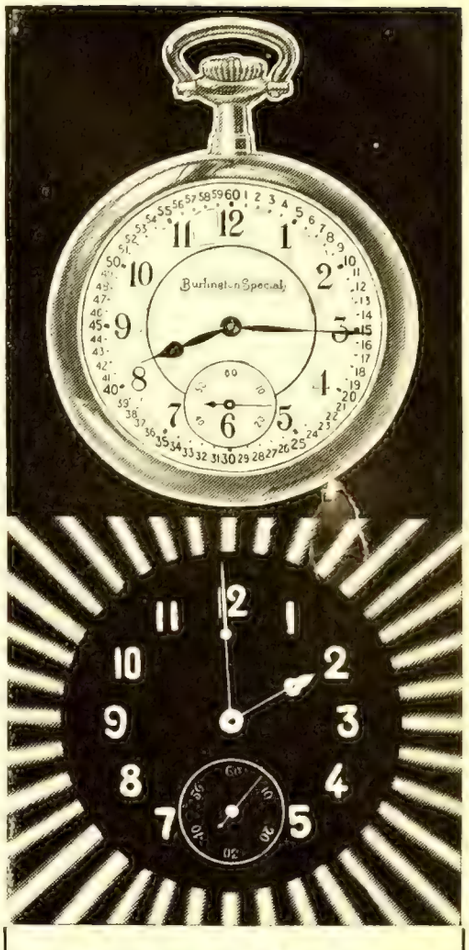
It is very convenient for traveling, being light and compact. It is made substantially throughout of pressed steel, heavily nickel plated and highly polished. The heating element is non-corrosive and non-oxidizable. It will stand intense heat without deterioration and is not affected by repeated heating or cooling. A special reflector intensifies the heat and deflects it downward. It is made by the Lindstrom-Smith Co., of Chicago, Ill.

BOOK REVIEW.

American Handbook for Electrical Engineers. Harold Pender, editor-in-chief., Prof. of Elec. Eng., University of Pennsylvania, formerly Director of Electrical Research, Mass. Inst. of Tech. Full morocco covers. 2050 pages, 7x4¼ inches. Gilt edged. Thoroughly illustrated. Price, $5.00 net. John Wiley & Sons, New York.

The book is a compilation of 260 articles upon the various branches of electrical engineering and allied engineering topics. The articles are arranged alphabetically with copious cross references. In addition, a detailed index occupying 60 pages is given at the end of the volume. The 26 authors of the articles are leaders in the engineering profession, and are well qualified to write upon their respective topics.

The articles cover the following sub-



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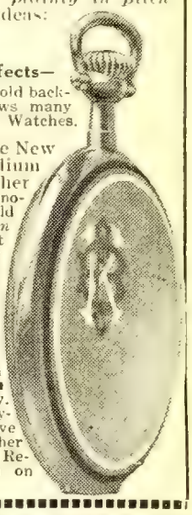

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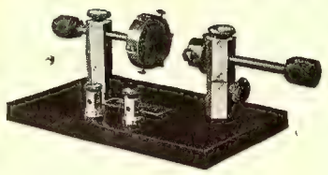

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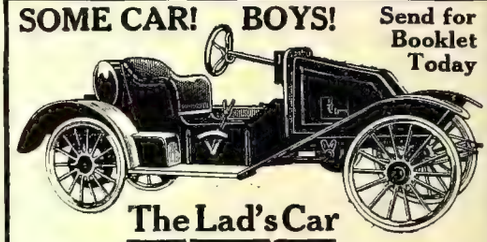

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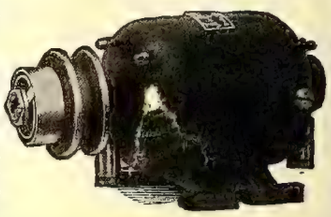

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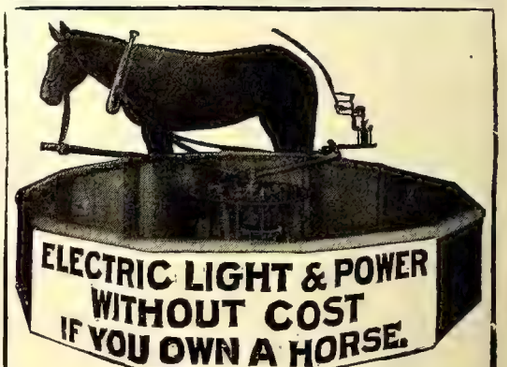

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Advertisements for the June issue should reach us not later than May 10th.

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

BOOKS

"TRAFFIC in Souls." This book is based upon the most widely discussed motion picture production. It is a powerful study of vice conditions in New York, and the facts upon which it is based were compiled from the Rockefeller White Slave Report. Illustrated with striking photographs. 300 pages. Send prepaid for 60c. Hesse Mercantile Co., 12 East 22d St., New York.

HANDSOME premiums to new subscribers' list; catalogue of 3,000 publications. 4c. Edwards Magazine Agency, Atlantic City, N. J.

"HUNDRED Ways to Kiss a Girl" and other things. Something real good. Price 25c. Bronx Girls Club, 417 E. 151st St., New York.

PIGEONS—The finest Pigeon Magazine, $1.00 a year, or send 25c. for four months' trial. Pigeons Magazine, 948 Advertising Bldg., Chicago.

MODERN Dances—Best Instruction Book for beginners. 17 dances fully illustrated. 25c. prepaid. Danse Publishing Co., 500 Fifth Ave., New York.

ENGINEERS' questions and answers for license, by Hobson for 25c., postpaid. Send stamps. Reilly's Book Store, Philadelphia, Pa.

BICYCLES AND MOTORCYCLES

CLOSING Out Sale high-grade slightly used motorcycles. We have about 50 left to sell, in standard makes which we are offering at big bargains, such as twin and single-cylinder Indians, Yales, Harley-Davidsons, Merkels, Thors, Excelsiors, Popes, 4-cylinder Hendersons and Pierces. These motorcycles we want to close out this year. No reasonable offer will be refused. Write to-day for list giving description and prices. Gotham Sporting Goods Co., 57 Warren St., New York City.

FOR Sale cheap. 1914 Harley-Davidson twin. Write for particulars. Walter Goerke, 321 Washington St., Newark, N. J.

1908 H. D. SINGLE with clutch and magneto, $30. 1910 H. D. battery model. A-1 condition, $35. 1911 H. D. single magneto model and clutch, $40. 1910 H. D. clutch and magneto, $45. 1 Indian motorcycle motor with magneto and Schebler carburetor, $25. 1 Excelsior motorcycle motor, $25. C. H. Lang, 1704 Michigan Ave., Chicago, Ill.

$50 TO $150 buys the best Motorcycles, every make and model in our large stock—must be cleared. Half price. Send for list to-day. Talking Machines, $5 and up. Brown Music Co., 9119 Commercial Ave., Chicago, Ill.

SEND for latest Bulletin of real Motorcycle Bargains, used and slightly used, all makes, models and prices; if you have $25 and really want a powerful Motorcycle, send for this Bulletin; hundreds of machines at all prices, new ones on easy payments; tell us what you want and how much you can pay; we can fix you up. Peerless Motorcycle Co., Dorchester, Mass.

USED Motorcycles, all makes, bargains. Send for list. Ward Bros., 212 Broadway, Camden, N. J.

OUR folder showing the new '15 Eagle 2-speed models is ready for mailing. Write for this and for the agency to-day. Sterling Motor Co., Brockton, Mass.

RIDERS: Write for our catalogue of motorcycle accessories and supplies. Andrews Specialty Co., 55 Warner St., Rochester, N. Y.

5-HORSE Pierce, single cylinder, magneto, Schebler carburetor, new tires, perfect running order, $125.00. Fred Gile, 50 Forest Ave., Portland, Maine.

GET copy of "Motor Cycle" published in England. Special War Issues received here weekly. Price 15c. Two for 25c. Distributors, 143 So. Wabasha, St. Paul, Minn.

* * * * * * * * * * * * *

Brooklyn, N. Y., April 15, 1915.

Gentlemen—The results obtained from my advertisement in the "Electrical Experimenter" really surprised me; in fact the demand for a certain instrument of mine exceeds the capacity for manufacturing and it is all through the "E. E." To date, 79 inquiries 12 orders. Might state last week filled a $50.00 *order netting me a profit of* $18.75. *As to the exact value of my orders to date, I prefer not to give figures; however, you will always see my ad. month in and month out. I can truthfully say that the "E. E." has it on them all, viz., for quick results, interesting reading matter, etc. Very truly yours,*

HARRY Y. HIGGS.

* * * * * * * * * * * * *

MOTORCYCLES, all makes, rebuilt, guaranteed good as new. Indians, Harleys, Excelsiors, Readings, Kulteres, Merkels, single and twins, $25 to $100. Buy direct, save dealers' profits. Deninger Cycle Co., Rochester, N. Y.

DON'T buy a Bicycle Motor Attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 27, Galesburg, Kan.

YALE, Pope, Thor, bargains. Late models. Walter Munger, Excelsior, Minn.

FORMULAS

LATEST FAD. The celebrated everlasting fragrant rose beads can be easily made and sold with big profit. Strings sell as high as $3.50 to $5.00. Formula with full instructions for making same, 25 cents coin. J. C. Regan, 1162 Broadway, New York.

IS the formula you want worth a quarter? State exact requirements. Raymond, Roosevelt, N. Y.

1,000 TRADE secrets and formulas, 25c. 500 selected formulas, 20c. Resilver mirrors, guaranteed process, 20c. Make Sneezing Powder and Itch Powder, 10c. each. Entire lot, 50c. Service Bureau, 3111-T, Belleplaine Ave., Chicago.

MAKE Candy evenings; pays; receipt, 10c. Elmer Zimmerman, 1435 Walnut, Harrisburg, Pa.

START factory making candies, gums, crackerjack, orangeade, ciders, etc. Sells fast. Nearly all profit. $15 course $1.00. Catalog, 2c. Robert Hamilton, Barnes City, La.

SIX Valuable formulas for sympathetic inks, 50c. Wayne Thomas, Ithaca, N. Y.

FORMULAS for inks, black, blue, red, gold, green, silver, indelible, 15c each. 7 for $1.00. Stephen Rafferty, 2122 Arch St., Philadelphia, Pa.

PHOTOGRAPHIC

WE buy, sell and exchange. Bargains in Microscopes, Telescopes, Binoculars, Cameras, etc. Bargain list sent. Kahn & Son, Opticians, No. 54 John St., New York. Established 62 years.

SPOT Cash paid for high-grade Kodaks, Lenses and Cameras. Send full description, stating lowest price. Cameras exchanged. In business since 1885. David Stern Co., Dept. M, 1047 W. Madison St., Chicago.

FILMS developed, 10c., all sizes. Prints 2¼x3¼, 3c.; 2½x4¼, 3½x3½, 3¼x4¼, 4c.; Post Cards, 50c doz. Work guaranteed and returned 24 hours after receiving. Postpaid. Send negatives for samples. Girard's Commercial Photo Shop, Holyoke, Mass.

ROLL Films developed 10c. per roll. Printing Post Cards, 3c. each. 15 years' experience. Give me a trial. You will be pleased. F. C. Hoyt, Sac City, Ia.

EXPERT Kodak Finishing! Send for price list. Electric Studio, 162 Stephenson St., Freeport, Ill.

KODAK films developed. 5c., all sizes. Prints, 3c. each, any size. P. Johnson, 100 W. Bridge St., Oswego, N. Y.

TRANSFER pictures to china, etc.; no formulas; particulars. Flinn, 286 West 142nd St., New York City.

THINK OF IT! Only $20 for finest German Double Anastigmat in Ibso shutter, for 3A Kodaks and postal card cameras. Send for matter describing best Lenses on earth at way down prices. Lafbury Co., 305 North Fifth Ave., Chicago.

FILMS developed 10c., all sizes, prints 2¼x3¼, 3c.; 2½x4¼, 3½x3½, 3¼x4¼, 4c.; Post Cards, 50c. dozen. Work guaranteed and returned 24 hours after receiving. Postpaid. Send negatives for samples. Girard's Commercial Photo Shop, Holyoke, Mass.

$54 CENTURY Grand, bargain, $25. Magnificent Ensign Reflex, Zeiss Triotar Anastigmat, complete, $65. $22.50 Autographic Kodaks, $19.75. Slipin Calender Mounts, assortment, $1. Catalogues mailed. Newark Photo Supply Co., Newark, New Jersey.

HEADQUARTERS for selling or exchanging Cameras of all kinds. Carry a full line latest Kodaks. Graflex. Premos, foreign Cameras. Write for big bargain list. Gloeckner & Newby Co., 171 Broadway, New York.

KODAK Films Developed, 10c. per roll, any size. Prompt attention given mail orders. Prints, 2¼x3¼ to 3¼x4¼, 3c.; 4x5 to 3¼x5½, 4c. J. M. Manning, Box B, 1062 Third Ave., New York City.

PRINTING

POSTPAID—1,000 envelope slips, 75c.; 500 two-color bond letterheads, or envelopes, $1.00. Samples free. The Ryder Print Shop, Dept. M6, Barnerville, N. Y.

PREPAID, Printing (600 miles) 1,000 bond letter heads, $2.39; envelopes, $2.14; return envelopes, $1.77; imitation typewritten letters, 150 words, $1.73; 300 words, $2.64; 6x9 circulars, $1.75; art ad slips, $1.00. Ask for prepaid prices on any printing. Good's Quick Print, Harrisonburg, Va.

MAGIC AND TRICKS

MAGIC pocket trick free. Worth 25c. With illustrated catalog of 250 tricks, puzzles, illusions, for 6c. Stamps. Magic Co., Sta. 10, 249 West 38th St., New York.

POST Cards, Tricks and Jokes, Coins, Notes, Stamps and curious things. Catalog for stamp. Coin Exchange, New Rochelle, N. Y.

BIG Catalogue. Magic, Entertainment goods free. Bates Co., Melrose, Mass.

MAGIC Tricks, Jokes and Puzzles. Trick with my catalogue, 10c. coin. H. V. Dils, Huntington, W. Va.

GREAT book wonders, secrets and mysteries and novelty catalogues, 10c. Wright Spec. Co. (D), Brewster, N. Y.

MAGIC tricks for the profession. Big catalogue and pocket trick free. Ventriloquial figures, $6.00 up. Magic Parlors, 192 Clifford, Providence, R. I.

NOVELTIES, Books, Tricks, Games, Etc. Illustrated catalogue free. Sample 25c. card trick, 10c. Auburn Supply Co., Specialty Dept., 7745 Peoria St., Chicago.

SECRO-WRITO; New System of secret writing. Keeps your correspondence safe and private. Strangers cannot read your cards and letters. Great fun for everybody. Samples and instructions, 10c. H. J. Teeple, Decatur, Indiana.

GREENBACKS—Yellowbacks, Stage money. New kind, 10c. bunch; 4—25c. Eureka Supply, P29, 3827 N. Kenneth, Chicago.

250 MAGIC Tricks with cards, coins, etc., 10c. Greenbacks, big wad, 10c. Novelty Shop, 3311-T, Belleplaine Ave., Chicago.

GREENBACKS—Big wad, 10c. 4—25c. Enterprise Co., 1003-PM, Morton Bldg., Chicago.

MAGIC Bargain Sheet and Catalog 2c. Gilnovco, Morgan Park, Ill.

GIVE 'em the "creeps" with the Mysterious Skull. Shines, without any light, in the dark. Really wonderful, 10c. Bartlett, Box 960, Milwaukee.

FAKE Money—Big, flashy roll, 10c. Gilnovco, Morgan Park, Ill.

MAGIC disappearing coin and ring trick, mystifies, amuses. Send 10c. in coin. Catalog. Powell Sales Co., Dept. E., Ossining, N. Y.

BE a Magician. Travel. Give shows; earn money. I tell how. Send stamp. Prof. Rapp, Box F1115, Madison, Wis.

BE a handcuff king. We teach you. Escape from handcuffs, boxes, ropes, etc. Secrets of 20 sensational escapes, $1. Particulars free. The Magicraft Co., Dept. A, Box 251, Detroit, Mich.

TRICKS, puzzles, jokes, cards, dice, ventriloquist figures, magic goods, sensational escapes and illusions. Big catalogue free. Oaks Magic Co., Dept. 180, Oshkosh, Wis.

MODELS

MODELS made for inventors; general machine work; designing and perfecting; developing automatic devices and machinery; in a position to do all kinds of light tool and machine work. Prices reasonable; estimates cheerfully given. Ideal Machine Works, 62 Ann Street, New York City.

INVENTORS: We manufacture metal articles of all kinds to order. Also special machinery, tools and dies; punchings, lathe and screw machine work, metal spinnings, castings, plating, wood and metal patterns, etc. Send sample for estimate and expert advice, free. The Eagle Mfg. Co., Dept. B, Cincinnati, Ohio.

I MAKE models for inventors and guarantee first-class workmanship; also do repair work and light manufacturing. George Wood, 223 Postal Telegraph Bldg., Kansas City, Mo.

PRODUCERS of Results; Inventions Developed, Light Mfg., Models, Experimental Work, Tools, Dies and Stampings. Johns Machine & Stamping Works, Middle Bldg., Dept. C, Cleveland, Ohio.

MODELS, dies and manufacturing for inventors, by builders of "Tools That Work." La Croix Tool Co., 214 N. 21st St., St. Louis, Mo.

WE make working models for inventors; also dies and stamping of specialties, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, 3405 Pierce Ave., Chicago, Ill.

ELECTRICAL and mechanical inventions developed, drawings, models, machinery, tools, etc., designed and made. Press work manufactured. Commercial Engineering Co., 142 Market St., Newark, N. J.

STAMPS AND COINS

STAMP Album with 538 Genuine Stamps, incl. Rhodesia, Congo (tiger), China (dragon), Tasmania (landscape), Jamaica (waterfalls), etc., 10c. 100 diff. Jap., N. Zld. etc., 5c. Big list; coupons, etc. Free. We buy stamps. Hussman Stamp Co., St. Louis, Mo.

GET the most out of your money you can. Try my 1, 2 and 3-cent approvals and you'll be pleased. References required. Wm. Haase, 971 E. 39th St., Los Angeles, Cal.

STAMPS—100, all different, free. Postage 2c. Mention paper. Quaker Stamp Co., Toledo, O.

FOREIGN Stamps Free, 52 different foreign, including China and Venezuela, to all who apply for our high grade approval selections. Send two cent stamp for return postage. Edgewood Stamp Co., Dept. H, Milford, Conn.

$4.25 EACH paid for U. S. Flying Eagle cents dated 1856. Hundreds of other U. S. and foreign coins wanted. Send 10 cents at once for new illustrated coin value book, 4x7. It may mean your good fortune. Clarke Coin Co., Box 94, Le Roy, N. Y.

MISCELLANEOUS

ENGINE LATHE, swings 9½ in., takes 25 in. between centers. Complete set gears, cutting all size threads, 3-in. to 40-in., $43.50. Grammes & Sons, Allentown, Pa.

AGENTS—Big money in perfumes, toilet articles, etc., make them yourself—we show you how. Mixers Supply Company, Poughkeepsie, N. Y.

GASOLINE Engine Castings, with drawings, cheap. Catalog for stamp. Novelty Manufacturing Co., 853 West 6th St., Cincinnati, Ohio.

SILVER Plating Tablets. Old brass or copper, spoons, watches, etc., can be instantly plated silver in a beautiful manner with the silver plating tablets. Sample tablet, 10c. Agents wanted. Utility Co., Cardston, Alberta, Canada.

100 IMITATION Elks' Teeth, guaranteed very fine, $2 each. H. Beddow, 2156 8th West, Seattle, Wash.

THREADED BRASS ROD, 8-32, 15c. foot. N. Lowry, 22 Wyoming St., Carbondale, Pa.

COLUMBIA Grafanola and eight records used one week, $20. Typewriter, two-color ribbon, back spacer, tabulator, etc., $30. Full particulars. Frank Cowles, Canton, Conn.

FATHERS, MOTHERS! Let your son learn a clean, high-class, educational trade that pays $1,200 yearly. Mastered day or evening. Unlimited course (usually takes three to five months), $150. Short courses also. Please call or write for particulars. EMPIRE MERGENTHALER LINOTYPE SCHOOL, 419 First Avenue, New York City.

RAISE Guinea Pigs — Great demand, thousands used yearly, more profitable than poultry or squabs. Easy to raise. I buy all you raise. Market assured. Please enclose stamp for full particulars. Edward F. Tobener, 2828 Woodland Ave., Kansas City, Mo.

FIELD-Marine Day and Night Glasses with case, 25-mile adjustment, $30.00 value, only $6.50. Money back if not satisfied. Ye Curiosity Shop, 20 S. Second St., Philadelphia, Pa.

YOUR PHOTO on a pillow top or handkerchief on high class material, Swaboda Satin; washable, will not fade. Pillow top in any one of 6 colors, namely: white, blue, green, lavender, pink or yellow. Prepaid to you, only $1; 6 for $5. Satisfaction guaranteed or money refunded. Rogers Supply Co., 4435 Washington Blvd., Chicago, Ill.

MAIL ORDER OPPORTUNITIES

EVERYTHING in the mail order line; state your wants and we will do the rest. Pacific Specialties Co., Los Angeles, Cal.

EUROPEAN War Map and chances to start a profitable business of your own, 10c. C. S. Mathews, 69 East 87th St., Portland, Ore.

WE will start you in the cleaning and dyeing business. Little capital needed. Big profits. Write for booklet. Ben Vonde System, Dept. A-K, Charlotte, N. C.

MAIL Order Men. Would you like to know how 61 successful mail order men do business? Especially if these men tell you their own experience in their own words. The Mail Order Business Builder gives you such information direct from these men's private offices from month to month. Send dime for sample copy of this 68-page magazine. Randolph Rose, Publisher, No. 8 Broad St., Chattanooga, Tenn.

WIRELESS

FREE—A beautiful Wireless Receiving Set enabling you to receive messages 300 miles, for selling only 25 boxes of my Spot Remover. Sells on sight. Be one of the first in your town to own a Wireless Set. Write now. Marge Co., 702 N. 6th St., East St. Louis, Ill. Dept. K.

GALENA DETECTOR, 2x2x2¼ in., shipped prepaid on receipt of 60c.; vulcanized base, heavy standard, large nickeled binding posts; excellent working instrument, and of neat appearance. The kind of instrument you have been wanting. Carl Rhapstock, Plainfield, Wis.

DETECTORS, tuning coils, condensers; everything in the wireless line. Bargains in all kinds of apparatus. Write M. Paul, 134 Dewey Ave., Jamaica, L. I.

"WIRELESS CHART" giving capacity, wave length, inductance, etc., values directly. Why wade through complicated formulas? "Chart," prepaid, 20 cents. Send stamp for list of labor saving charts. H. Secor, Consulting Engineer, 2040 7th Ave., New York City.

AMATEURS! Exceptional radio apparatus; my type "A" special amateur tuner, a guaranteed interference preventer, tunes up to 1,500 meters. Price $6.00. Send 2c. stamp for catalogue. H. Y. Higgs, 30 Irving Pl., Brooklyn, N. Y.

Scientific Exchange Columns

UNDOUBTEDLY you have at the present time some things for which you have no further use. Do you wish to sell these things or exchange them for something, for which you have immediate use? There is no surer and quicker way to do this than by advertising your articles in these columns. The **Very** people, the **Only** people, who could possibly have a use for your things read this journal. More than 30,000 interested people will see your ad. It is furthermore the cheapest advertising medium for you in the country.

The rates are: One cent per word (name and address to be counted) minimum space 3 lines. Count about 7 words to the line. **Remittance must accompany all orders.**

We reserve to ourselves the right to refuse any advertisement which we consider misleading or objectionable. Advertisements for the June issue should reach us not later than May 10th.

The Classified Columns of "The Electrical Experimenter" Bring Positive Results.

WILL SELL "Edison—His Life and Inventions," 2 vols., 990 pages, illustrated, cost $4.00; 4-ohm key and sounder, 6-v. 4-c. electric bulb and socket, Dodge's "Telegraph Instructor," all for $4.00. Mark Kistler, Centreport, Pa.

WANTED, TO SWAP—Good 5x7 view camera with F6 symmetrical lens and tripod and carrying case; practically new. Will trade for good wireless set. Carl Caufield, Niles, O.

HAVE a new camera and outfit; also a new mandolin, guitar, cellaphone. Will trade for phonograph, typewriter or electrical apparatus. Ralph Thouson, Towner, N. D.

WILL SELL new omnigraph, cost $9.00, for $5.00. John Tuger, 668 Park Ave., Brooklyn, N. Y.

FOR SALE OR EXCHANGE—Rotary gap, electrolytic detector, some No. 4 copper wire and several pieces of detector mineral. I would be pleased to exchange photos of radio set. Address Cecil Bridges, Louisville, Ill.

FOR EXCHANGE—Large factory-made receiving transformer, Morse inking register with rolls of tape, for disc talking machine or offers. H. Butterworth, 15 Kosciuske St., Brooklyn, N. Y.

WILL EXCHANGE 250 ft. motion picture film for good loading coil. Chaafie, 103 Prospect Ave., Hackensack, N. J.

FOR SALE OR EXCHANGE—Wireless goods. Send for descriptive circular. Address Merle Y. Hodgkins, 42 Wellington St., Waltham, Mass.

TO SELL—Knapp type "S" dynamo motor, 9-volt, 3,000 rev.; perfect condition, except pulley. Cash $4.00. Will run sewing machine, etc. Merrill Palmerton, Collins Center, Erie Co., N. Y.

FOR SALE—One 2,000-ohm head set with split headband, one 22-calibre Savage rifle, one Voltamp Marvel dynamo motor and one No. 2 Brownie camera; all in first class condition. W. B. Main, Calais, Me.

FOR SALE—One Electro, Jr., loose coupler, one nine-plate variable condenser, one electrolytic detector, one pair Electro 2,000-ohm phones; all good as new. Carl Mathiasen, Onawa, Ia

FOR SALE OR EXCHANGE—Half horsepower two-cycle gasoline engine, "Auto Sparker" dynamo, telescope, bicycle lamp (gas), books, magazines. Want microscope, camera, storage battery, or what have you in the electric line? John Wells, Moosomin, Sask., Can.

WILL SELL my sending and receiving outfit, aerial, insulators, etc. Write and state what you need. Phil Schmitt, 1337 Third Ave., New York, N. Y.

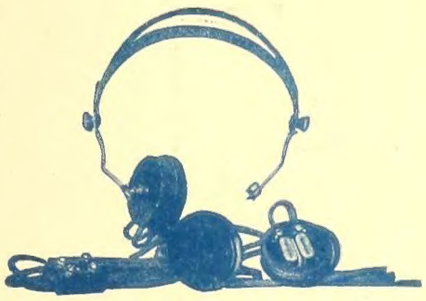
FOR SALE—1½-in. spark coil, helix, antenna, switch, Junior fixed condenser, 4-bar generator, No. 14 aluminum aerial wire and 20 good switches. Vernice Sell, 514 N. Webb Ave., Alliance, O.

FOR SALE—½ K. W. open-core transformer, $5.00; glass-plate condenser, 10 plates, 6½x8½, $1.50; electrolytic interrupter, $1.50; good, heavy spark gaps, $0.75; key with leg screws, $0.75, and a helix, $0.75. All in good condition. $10 takes entire lot. Philip M. Foote, 146 E. Frambes Ave., Columbus, O.

FOR SALE—$150.00 worth of wireless and electrical goods, and Berry's "Horsemanship Course" in 8 books, cost $15.00; or will exchange for stamp dealer's outfit or typewriter. Albert L. Hoydar, Fairfield, Neb.

WILL SELL polarized relay, coherer, tape register, fix and rotary condensers, Ferron detector and E. I. vario selective coupler (Mignon); also film-developing tank. Max Kuhne, 94 River St., Hoboken, N. J.

THE NEW
MURDOCK SPECIAL No. 55
WIRELESS RECEIVERS



With Regular Head Band

Complete
2000 Ohm Double
Head Set
ONLY
$4.00

With Coronet Head Band $4.50

Absolutely high grade real wireless receivers, equal in sensitiveness, quality of materials, and dependability to any obtainable anywhere at many times the price.

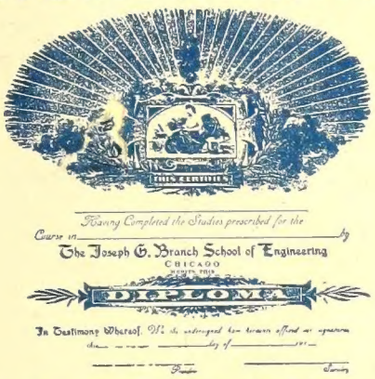
We will, upon receipt of price, deliver a Murdock Special set, with the privilege of fourteen days trial. If for any reason the purchaser is dissatisfied, either with the receivers or our claims, the purchase price will be immediately refunded upon return of receivers.

SEND FOR CIRCULAR GIVING FULL DESCRIPTION OF THIS NEW HEAD SET

680 HOWARD ST.,
SAN FRANCISCO, CAL.

WM. J. MURDOCK CO., 55 Carter St., Chelsea, Mass.

Practical Courses of Study
ELECTRICAL ENGINEERING



The men who get the **big jobs** are the men who understand the **principles** of electricity and their application.

Our Electrical Course teaches in plain, simple language and with easy lessons how to install and operate electrical machinery and appliances.

These lessons in Practical Electricity cover both Direct and Alternating Currents, high potential and high frequency currents, and all that is necessary to become a proficient electrical engineer.

The Course completely covers the field of practical electricity, including power-plant work, and the following subjects, viz.: Practical Electricity, Alternating Currents Simplified, The Electric Motor, Electric Wiring and Practical Mathematics.

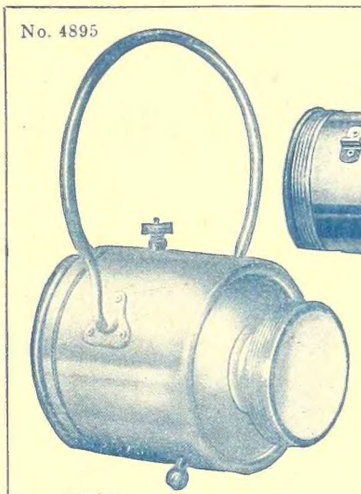
FREE Ten text-books, handsomely bound, printed in large, clear type on fine quality of paper and profusely illustrated, are furnished **free** with this course.

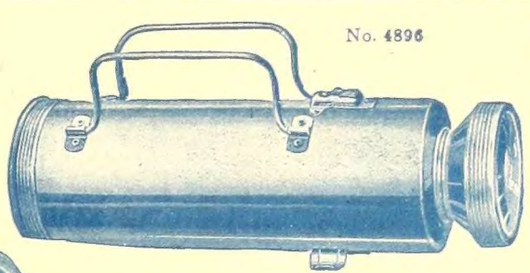
The instruction is made so clear that any one can understand it, even though he has but a limited education.

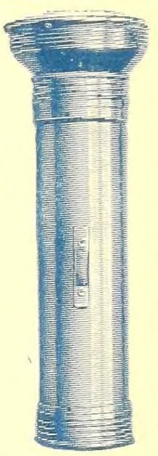
The success of this school is due to the fact that we give the student only what he should know in order to become competent, and we do not waste his time and effort on useless matter.

THE PRICE IS LOW AND THE TERMS ARE EASY

THE JOSEPH G. BRANCH
SCHOOL OF ENGINEERING
608 South Dearborn Street, CHICAGO







ONLY A FEW ITEMS OF OUR LARGE LINE

No. 6768

QUALITY FRANCO TRADE MARK **PRODUCTS**

1st Class Dealers Carry Our Line

If your dealer can't supply you, write us and we will give you name of nearest dealer who can.

Interstate Electric Novelty Co.
29-31 Park Place, New York

Chicago: 541 Wash'n Blvd. **San Francisco:** 111 New Mont'y St. **Toronto, Can.:** 220 King St., W.

THE FAMOUS "FRANCO" PENLITE $1.00

OUR NEW 272 PAGE CYCLOPEDIA No. 15

IS WAITING FOR YOU

FULL SIZE FAC-SIMILE OF OUR CATALOG COVER
JUST AS IT LOOKS WHEN YOU GET IT

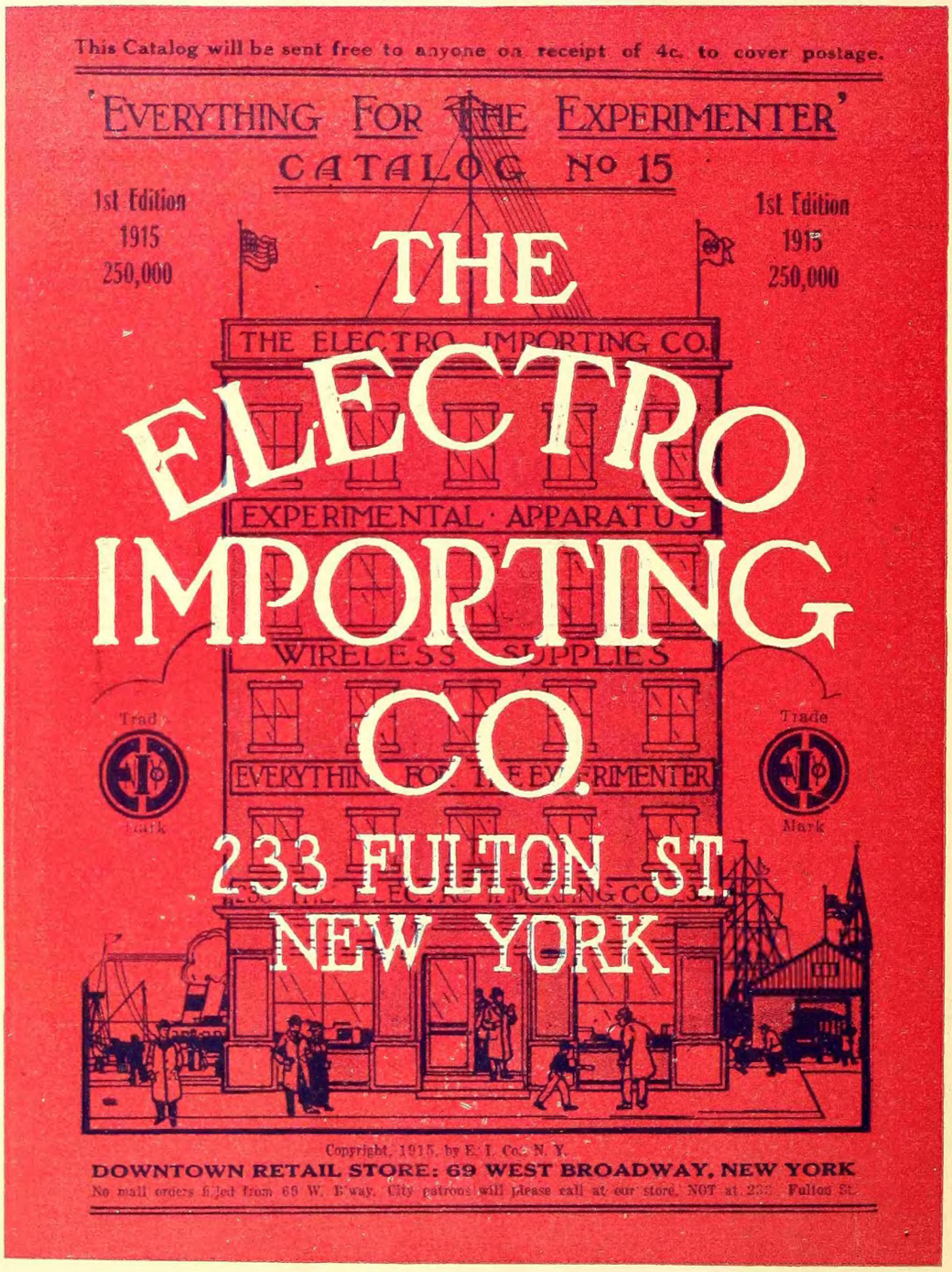
½ INCH THICK WEIGHT ½ POUND

Some of the questions answered in Cyclopedia Catalog No. 15:

The Wireless Law of August 13, 1913.
How to Receive Wireless Messages.
How Far You Can Telephone by Wireless.
Wave Lengths of Principal Radio Stations.
How to Erect a Wireless Aerial.
How to Receive Time by Wireless.
How to Photograph Electrical Discharges.
How to Experiment with Spark Coils.
How to Test Storage Batteries.
How to Make Tesla's Experiments.
Call Letters of all Commercial and Government Wireless Stations.

TRADE MARK.

How to Calculate Radio Wave Lengths.
What Is Ohm's Law?
Resistances of Different Metals.
Capacity of a Condenser.
How Far a Spark Coil Will Send.
What Size Wire Receivers Are Wound with.
How Receivers Are Made.
How to Charge a Storage Battery with A. C. Current.
How to Produce a 3-Inch Spark Without Batteries, Coils or Current.
How to Solder Aluminum.
What Is a Joule?
How Many Grammes in a Drachme, etc., etc.


This Catalog will be sent free to anyone on receipt of 4c. to cover postage.
'EVERYTHING FOR THE EXPERIMENTER'
CATALOG No 15
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1st Edition 1915 250,000
THE ELECTRO IMPORTING CO.
EXPERIMENTAL APPARATUS
WIRELESS SUPPLIES
Trade Mark
Trade Mark
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NEW YORK
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